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RIL 22, 1946
LUME 35, No. 8

AMERICAN DYESTUFF REPORTER

IAL PUBLICATION
of the
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EXTILE CHEMISTS
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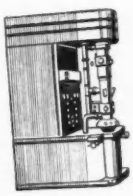

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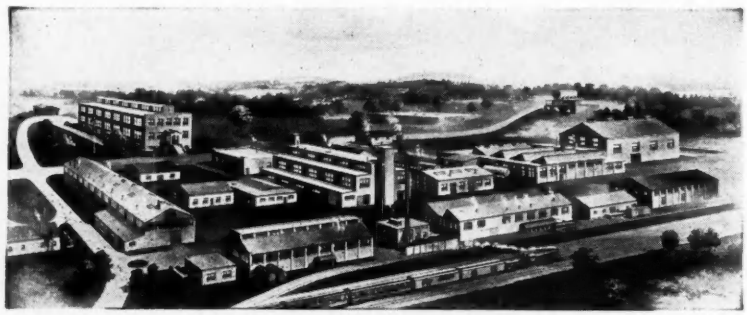

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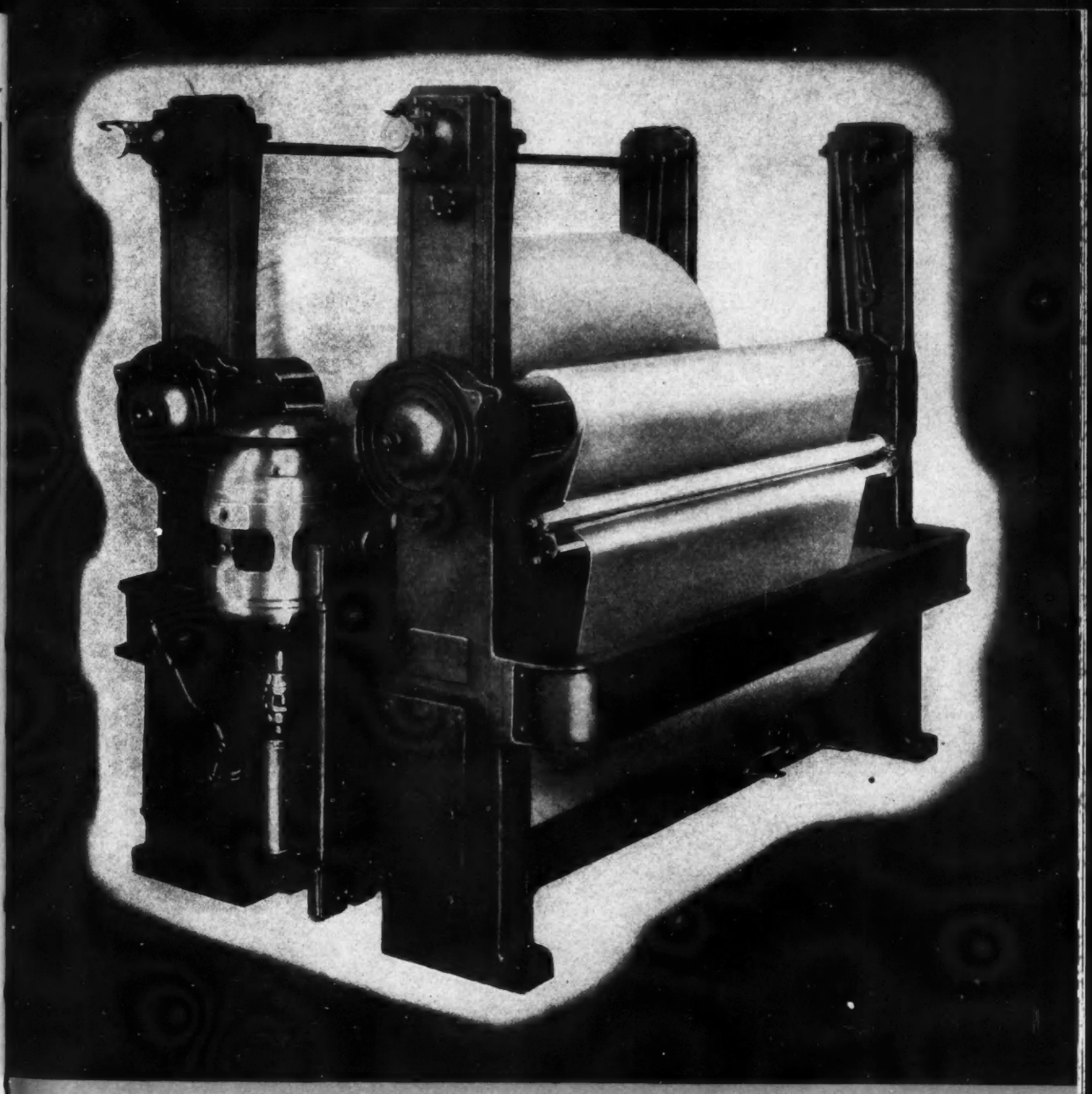

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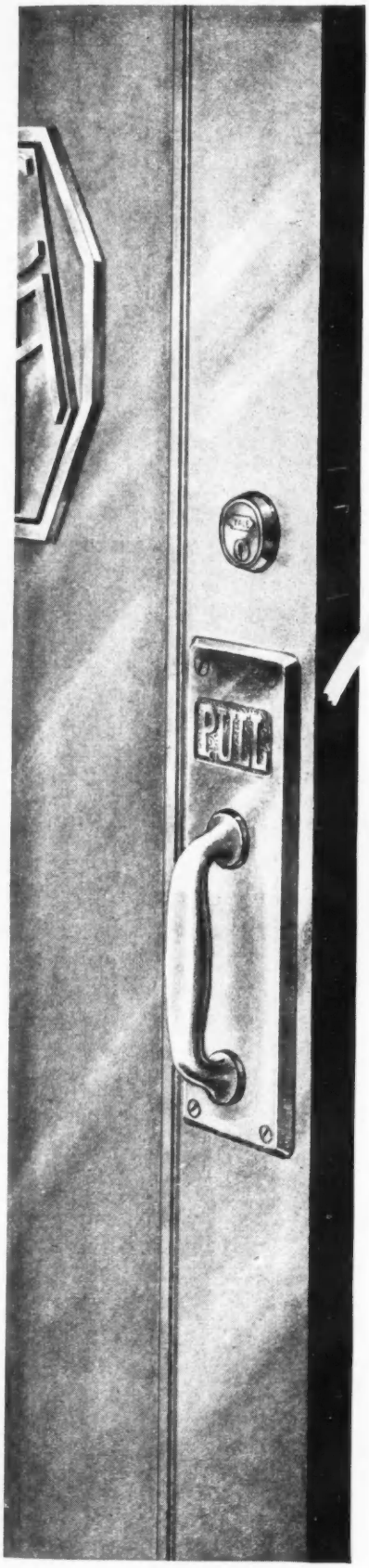

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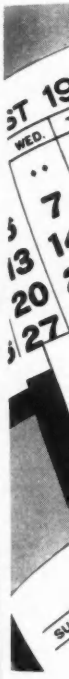

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3 case histories of trouble in dyeing cotton and rayon

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A cotton converting plant was having trouble in package dyeing. The yarn had a dry, greasy feel on the outer and inner portions of the package, and the dyed yarn crocked quite badly. Analyses showed that lime and magnesium in the water was precipitating soap and oils from the preliminary scour and from the dye bath, causing a film of metallic soap to form on the outer portions of the package.

THE CURE

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Case 2

In a rayon converting plant, pieces were constantly being returned from the finishing department to the dyehouse to remove stains. These were characteristic scum stains, and scum was found on the surface of the dye liquor in all dyeing equipment. This scum was analyzed and proved to be lime soap.

THE CURE

Calgon was added to the dye bath—and the number of pieces returned from the finishing department dropped practically to zero.

Case 3

Dyed rayon crepes showed lighter patches along the selvage, and had to be returned for redyeing. It was found that pieces often had to wait at the continuous boil off machine, and that as the selvage of these pieces began to dry out, the same sort of blotches appeared. Soap was concentrated in these places and the blotch felt hard and stiff.

THE CURE

Calgon was added to the last rinse of the boil off machine. Then, if the pieces had to stand before going into the dye box, the dried out portions of the selvage dyed uniformly with the rest of the goods.

There are dozens of places in the textile industry where the use of Calgon will save trouble, cut waste, reduce rehandling. For full information on these applications, write for Technical Bulletin No. 3, "Calgon Data for the Textile Chemist." We will be glad to send you a copy.

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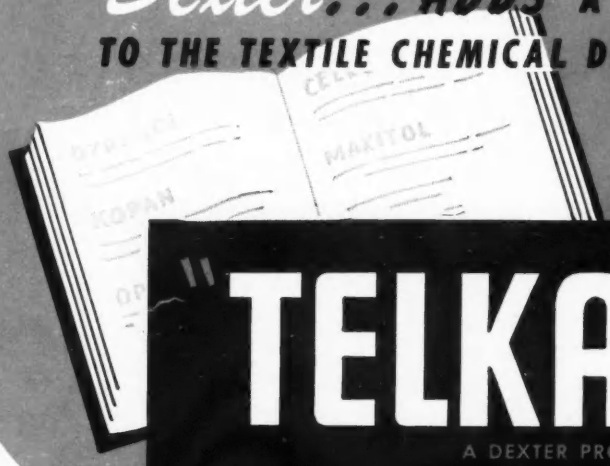

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Telkanol provides improved fastness to rubbing. Prevents precipitations of direct dyestuffs sensitive to lime.

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Tell us in detail about your wool-dyeing problems. Our technical staff will study them and make specific recommendations. There is no obligation.

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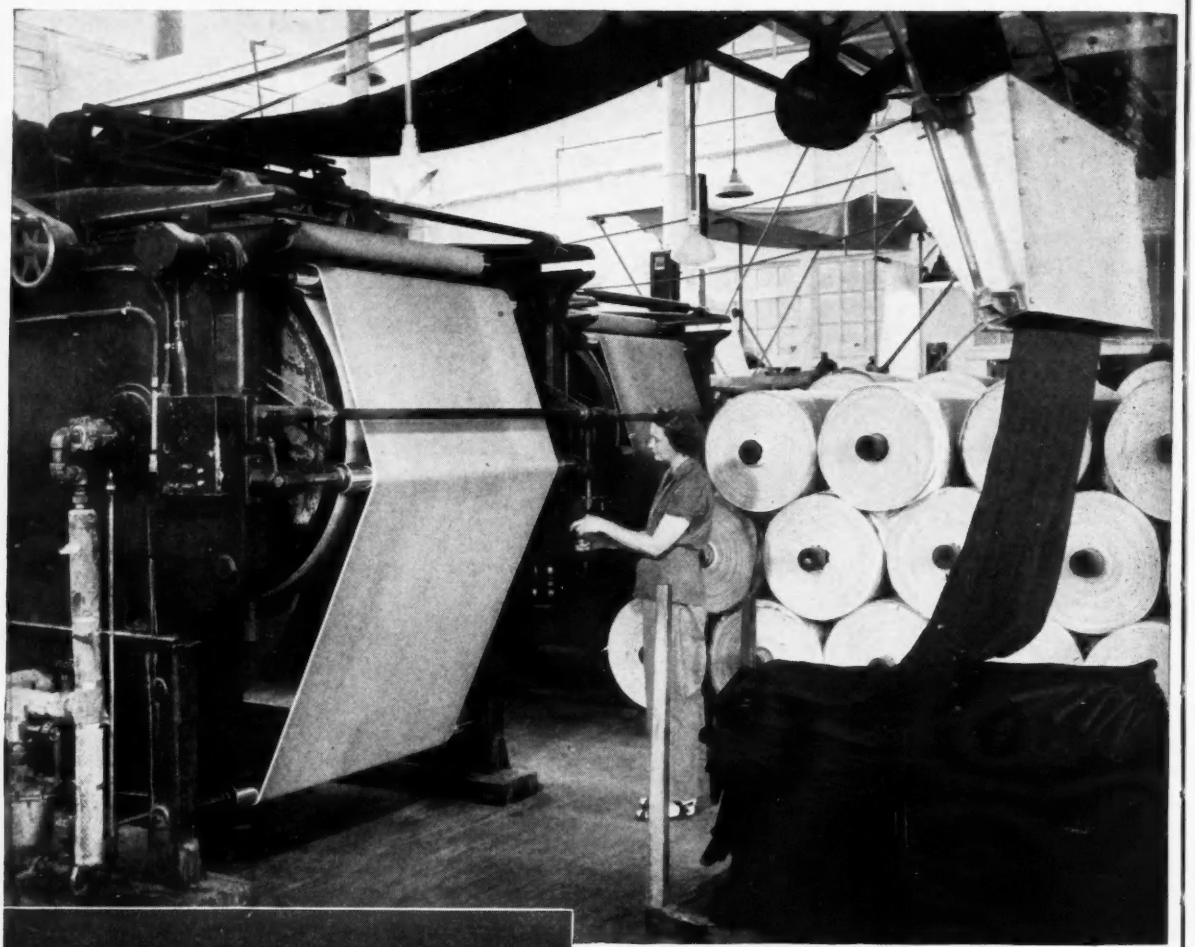

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How would **YOU** *print this pattern?*

Pacific Mills selected a rather unusual, but simple, procedure for producing this design on a cotton fabric for utility shirts. First, the pattern was printed with Aridye* Pigment colors, using the following formulas:

Brown . . . 3 parts Aridye Brown FWR, 1 part Aridye Yellow FYK, 1 part Aridye Black FK; cut 1:16 with Aridye Clear.

Orange . . . 2 parts Aridye Orange FO, 1 part Aridye Scarlet FSG; cut 1:6.

After printing, fabric was dried on cans. Next, the ground was dyed, using 13 parts Aridye Yellow FYK and 1 part Aridye Black FK; cut 1:60 with Aridye Clear. Dyeing, pre-drying, drying and curing were carried out in one continuous operation on a pigment dyeing range consisting of a padder; pre-dryer; housed, heated tenter frame; and curing oven.

Result: a sharp, clear pattern which closely simulates a woven design. Fastness to light, laundering and perspiration met every requirement.

This particular pattern is typical of the unusual effects which can be achieved with Aridye Pigment Colors, but which would be difficult to obtain by conventional methods. Aridye Pigment Colors are proving advantageous, too, for many every-day printing jobs.

Why not have an Aridye technical service man discuss your printing or dyeing problems with you? Write to Aridye Corporation—Pioneers in Pigment Colors for Textiles—Fair Lawn, New Jersey.

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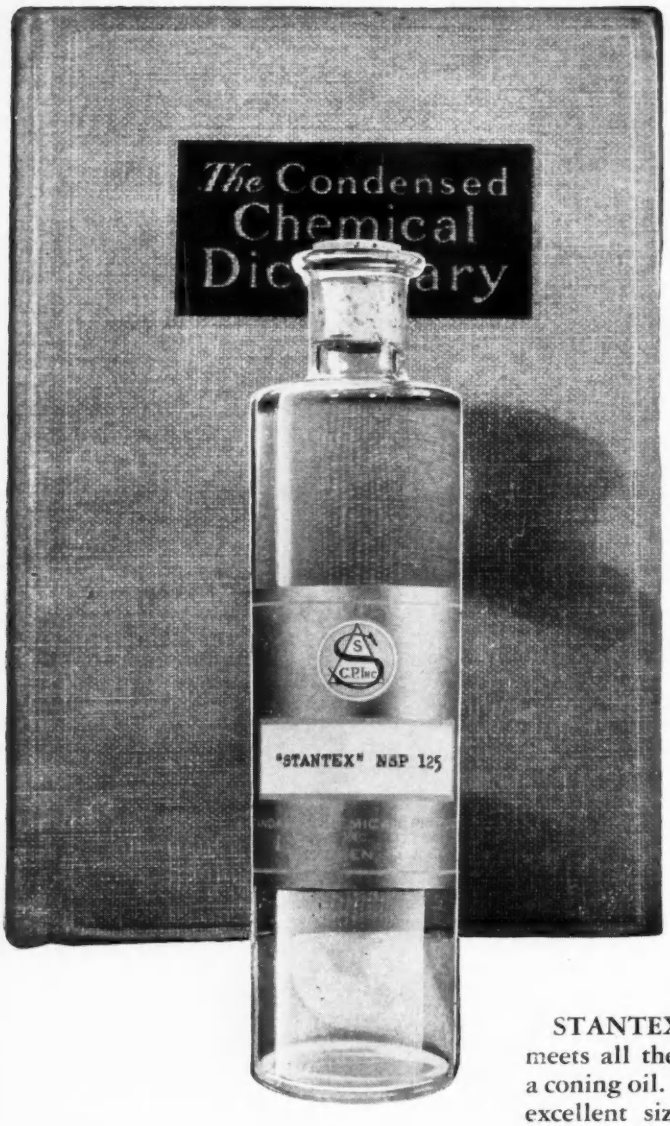

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Official Publication of the Proceedings of the American Association of Textile Chemists and Colorists

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Published every other Monday by
HOWES PUBLISHING COMPANY, INC
One Madison Avenue, New York 10, N. Y.

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APRIL 22, 1946

VOLUME 35 NUMBER 8

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An Advanced FABRIC WEAR TESTER*

W. H. MASTERSON

Engineer, Better Fabrics Testing Bureau

THE ultimate interest of the textile technician and manufacturer in testing is to determine how a product will perform in consumer service. "How will it wear?" is a stock order among patrons of the public testing laboratory.

Customers of the Bureau use our laboratory to predict wear in service the consumer may expect from new products, but we are often handicapped in doing a complete job because of the lack of adequate and reliable abrasive wear testing machines. Actually, the wear figure of a new fabric is as important in its ultimate use evaluation as color fastness or other properties of serviceability.

The wear evaluation of fabrics becomes more important each year, because of the growing trend toward lighter weight goods and the expanding practice to blend fibers of different basic characteristics with respect to softness and shrinkage qualities.

We have a background of experience on which to draw in predicting serviceable wear of goods composed of the so-called natural fibers, but we are sometimes perplexed in evaluating many of the relatively new fabrics, particularly when they have been treated with resins or finished by methods untested for their ultimate effect on the consumer wear of the product.

The industry, but more specifically the testing laboratories, needs machines for conducting abrasive wear studies, and in turn standardized methods of performing tests and evaluating test results. The very future of testing is dependent upon development and adoption of suitable apparatus for scientific testing of both consumer and industrial textiles.

I must not give the impression that there are no wear testers now in use or that considerable study and development work has not been done on wear testing and its evaluation. Much work has been done and many machines have been produced. In fact, too many wear machines have been invented, if I may speak a word of criticism. Why, in my own laboratory we have four types in daily use, and to wax facetious, I can get four results on the same fabric if it is subjected to the varied list of wear testers.

Let us now turn to a brighter outlook on fabric wear testing. Because success has not yet crowned our research efforts in wear testing is no reason to give up or lessen this important work. Rather, the complexity of the problem of scientifically predicting wear durability by mechanical tests holds unusual interest for those whose abilities qualify them to pursue such work.

Instead of discussing in the limited time allotted me the numerous types of wear testers now used in private and public laboratories, I desire to have you consider with me the advanced points of merit we have found through use of a fabric tester used in England and in our Bureau here in New York. This tester is not suitable for all weights of cloth; indeed, in its present development it is ideal only for velvets and fine goods of wearing apparel weight. However, it possesses features considered by us to be fundamental in principle in a fabric wear tester. I have listed 8 of these principles for discussion.

First. The test fabric is exposed to wear while curved at a 90 degree angle over a rotating spindle because clothing is subjected to such wear at cuffs and garment edges. The test result reflects exposure of the fabric under extreme wear, yet to typical conditions of wear in consumer service.

Second. The test fabric is held under tension in a curved position to simulate the edge of a garment, where clothing fabrics get positive wear without regard for elastic properties.

Third. The pressure of the abradant fabric is controlled by speed of the spindle holding the test fabric, insuring that increased speed per r.p.m. correspondingly lessens pressure on the wearing surface, thus avoiding irregular wear and overheating of the cloth.

Fourth. A feature of the tester is that it provides for light pressure of the wear sample against the abradant cloth, thereby producing true wear instead of cutting away the fibers composing the test sample.

Fifth. The machine is self cooling and self cleaning with respect to the test fabric. Speed of the wear spindle is about 1000 revolutions per minute, a rate sufficient to "dust" the fabric under test and keep it cool by circulation.

Sixth. The required size of the test sample is minimum, which is often desirable to the public testing laboratory. All to often the customer gives no consideration to an advantage for him if he would furnish a large cut of cloth for abrasion or other tests, because in doing so the laboratory technician is enabled to select a representative piece for testing and make check-tests if weakened or ruptured yarns not visible to the eye are disclosed by partial test.

Seventh. The time consumed in making a test is assuming more importance in the public testing laboratory. The time required for the wear test on this machine is relatively short; therefore, it is possible to "run" two or more samples for averaging test results, and in the interest of accuracy.

Eighth. The best recommendation of this wear tester is that it produces check results on fabrics for which it is suited. Perhaps this claim should have been number one, because the strongest indictment against fabric wear testing is failure of testing machines to give "repeat results" along with the variations reported by competing laboratories.

A summary of my claims for this somewhat new tester is the basis of my recommendation that the American Association of Textile Chemists and Colorists undertake further development of wear testers on the principles found in this machine. And I believe a standard for evaluating wear test results should be formulated to require at least three ratings of test samples, (1) when noticeable wear is detected, (2) when the surface at worn areas changes from original appearance, and (3) when yarn ruptures produce holes resulting from fiber wear. The standard should provide for tensile strength breaks of the three sets of worn samples as a basis of evaluating the durability of products requiring strength of fabric incidental to consumer use. At present fabrics are simply evaluated on the basis of eye measurement of resistance to abrasive wear, though actual durability in use is often as much dependent upon strength of the cloth as its surface appearance. Especially is this true in the examples of utility or work clothing and household domestic goods.

(Concluded on Page P204)

* Presented at Meeting, New York Section, February 15, 1946.

The Continuous Indicating pH METER-LINE OPERATED*

FRANK PAULLY

Macbeth Corp.

IT is about nine or ten years since the pH meters using the glass electrode have been available. It is surprising within this length of time how few pH meters are actually used in plant process control. We still find a considerable amount of colorimetric comparators in plants, and recently the colorimetric indicator strips.

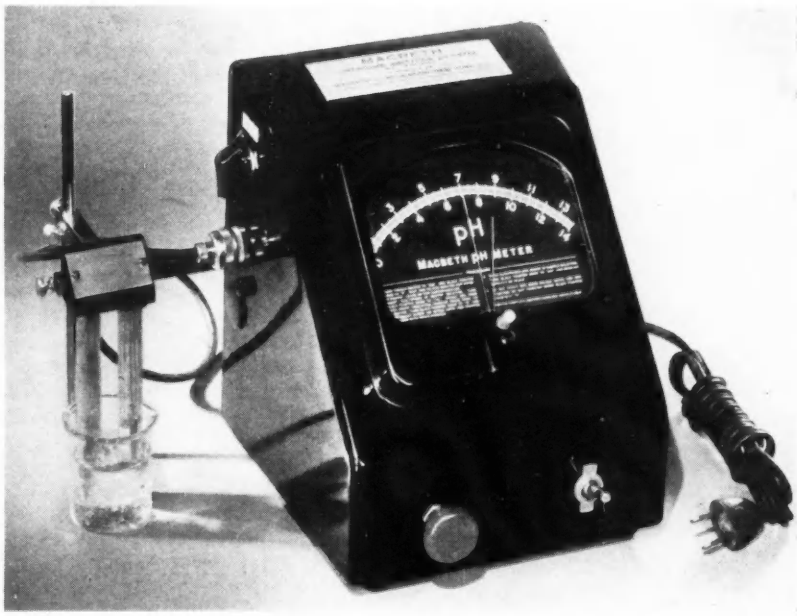
The problem of the unpopularity of the glass electrode pH meter in the plant may be due to the design. A considerable number of controls are required for the proper adjustment of the instrument, and a technician having a certain amount of skill is required.

Another disadvantage of present-day pH meters has been their batteries. An instrument that is left on continuously, such as would be desirable in a plant, would require battery replacement probably every three months.

In attempting to provide an instrument that would appeal to the plant opertator, we have produced a unit that is completely line operated. We also have provided a unit that provides an automatic indication. That is, it requires only one control for standardization, and a switch that is turned between changes of samples. The unit is housed completely in an aluminum casting, with an indicating meter that is calibrated at .1 pH units from zero to 14.

There is no temperature adjustment, because it is felt that the temperature error is probably within the limits of .1 pH. We have also attempted to remove some of the mysticism of pH meters by making the instrument completely accessible for servicing by the plant instrument department, if required, by mounting all the components on one chassis, with the amplifier tubes and the rectifier and the voltage regulator.

Although the instrument is continuous in operation, we have not as yet been able to recommend that it be used on piped samples. There is a difficulty in continuous running samples in that the sample line is usually grounded, and since the measuring electrode of the instrument is also grounded, there is liable to be difficulty if the system is not properly insulated.



Continuous pH Meter-Line Operated

We have probably gotten ahead of ourselves in not explaining the functioning of a pH meter. A pH meter is actually a high resistance millivoltmeter which measures a cell voltage consisting of the measuring electrode which in this case is a glass membrane and a reference electrode which is a calomel electrode, and the solution which may be considered the electrolyte of the battery. The voltage across these two electrodes will vary in accordance with the hydrogen-ion concentration of that solution.

Since we are measuring a voltage through a glass membrane, we have a system of very high resistance in the neighborhood of 1000 megohms. In order to measure a voltage for such a high resistance, it is necessary to provide a system that draws very little current from the measuring system. In order to do that, we operate two vacuum tubes as an electrometer and have provided an adjustment so that the current drawn through these tubes is extremely minute.

Another requirement in a continuous meter is to have stability. In order to do this, we have provided a balance bridge circuit so that any variations that may occur in the line voltage or circuit would affect both tubes equally and no effect would be observed on the output of the circuit. In order to allow for extreme voltage fluctuations, we have provided a voltage regulator, and the voltage regulator functions over a range of 100 to 130 volts.

One of the difficulties in using a glass electrode pH meter in the plant has been due to humidity effects, and in a high resistance measuring circuit, such as is produced with a glass electrode system, care has to be taken that there is no electrical leakage from the terminals of the glass electrode.

In order to permit this instrument to be used under conditions where high humidities will persist, we have provided an input terminal with a long leakage path to ground. Further, it is inside the instrument, so that it is always at an elevated temperature, so that the relative humidity at the criical point is kept low, even during long periods of constant high humidity.

(Concluded on Page P204)

* Presented at meeting, New York Section, February 15, 1946.

THE DYEING OF "VINYON"*

JACKSON A. WOODRUFF

Textile Research Dept., American Viscose Corp.

AMONG the many synthetic fibers which promise to increase the scope of application of textile materials in post war fields, "Vinyon"[1, 2, 3] is one of the oldest, yet its years of commercial use may still be counted on one's fingers. The "Vinyon" referred to here has been described in detail many times, so that for the present description it should suffice to say that "Vinyon" is a copolymer of vinyl chloride and vinyl acetate (approximately ninety parts of chloride to ten parts af acetate) having in the finished product high resistance to alkalies and acids, good wet and dry strength, negligible water absorption, and having solubility in certain organic solvents. Like other synthetic filaments it is usually stretched after the formation of the filament, in order to obtain increased strength through orientation of the copolymer chains. As a matter of interest, it may be mentioned that no evidence of crystallization is apparent by X-ray analysis before or after stretching.

In this paper unstretched yarn will be referred to as UST "Vinyon," highly stretched yarn will be referred to as HST. This stretching factor is of importance to the dyer because it will be found that the dyeing of the unstretched material while unusual is comparatively simple. The highly stretched material, however, provides more perplexing problems. Exposure to temperature in excess of 65°C. will cause the HST "Vinyon" to tend to assume the original dimensions which it had before being stretched in manufacture. The UST "Vinyon" having much less inherent shrinkage can be treated in water at much higher temperatures without excessive deformation. Another result of the stretching after spinning is that it is practical to make HST "Vinyon" yarns with a low filament denier.

The uses of "Vinyon" have developed for the most part in situations in which advantage has been taken of the physical and chemical properties of this material. Relatively few of these uses require dyeing but sufficient interest has been shown in uses requiring dyeing to have promoted considerable investigation in the past several years. This work, in addition to making possible the dyeing of "Vinyon" has provided interesting analogies and methods of approach to dyeing problems on other materials notably cellulose acetate and nylon as well as some of the more embryonic textile materials.

To begin with it may be said that usual methods of application of the more common dyes with the exception of basic dyes, fail to do more than stain "Vinyon." Due to the lack of fastness properties of this one class of dyes, and for other reasons which will be mentioned later, basic dyes have been of little commercial use. The first successful method of applying other dyes in a full range of colors was done by applying water dispersed acetate dyes in the presence of water soluble swelling agents for the "Vinyon" such as methyl isobutyl ketone.[4] The next line of approach was by the use of selected water dispersed organic materials which were absorbed from such a dispersion along with dyes to produce swelling and dyeing of the "Vinyon."[5] These organic materials were given the name of "assistants" and that term is now generally used to described this type of dyeing with acetate dyes on "Vinyon."

An "assistant" is a chemical which when used in a dispersing medium, for instance, water and dye, swells the 'Vinyon" to the extent of allowing absorption of the dispersed dyes within those parts of the "Vinyon" swollen by the chemical. No easily water soluble "assistants" have been found which are economically practical for use in water mediums and no "assistants" have been found effective unless the dyes themselves are soluble within the same.

One other method of swelling the "Vinyon" material has been found and while the objectives and the mechanics involved are the same as "assistant" dyeings, the deviation away from the use of water as the major portion of the dyeing medium has prompted the designation of solvent dyeing to differentiate from "assistant" methods. One typical solvent dyeing medium is water, ethyl acetate, and ethyl alcohol. Another solvent used for different type dyes is full strength ethyl cellosolve.

In order to make the over all picture of dyeing "Vinyon" more clear, the writer has divided the dyes used into classes in accordance with their method of absorption or adsorption on this material.

CLASS I

This class is for dyes which by themselves have solubility in "Vinyon" filaments. In other words, they are their own "assistants." They enter "Vinyon" because they have the ability to become a physical part of the material itself, and if present in sufficient excess can plasticize the "Vinyon." One example of this type of dye is Fast Red KB Base, using β-Naphthol as developer.

The latter chemical in sufficient concentration can readily plasticize "Vinyon" at 130°F. There is some indication that pigments made from such a combination can also dye "Vinyon" in this same manner of absorption. Those dyes which have been found to be in this class have all been hydrophobic materials and have fallen in the category of naphthol, oil soluble, and a few organic pigment colors.

CLASS II

This class includes dyes which have a very limited solubility (less than .01% on the weight of "Vinyon") by themselves, but which are dissolved in "assistants" or solvent mediums, which are in turn soluble in "Vinyon" in sufficient degree so as to cause swelling with accompanying retention of the dye in the area affected by the swelling. Broadly speaking, this classification applies to nearly all dyes not soluble in "Vinyon" by themselves, since it is probable that by tedious selection of "assistant" or solvent medium, solubility for the dye could be obtained in the selected chemical accompanied by swelling and dyeing of the "Vinyon." However, for the purpose of this paper, this class is restricted to those dyes which have in work to date lent themselves to relatively easy application of the principles involved. These include nearly all the "direct dyeing" acetate colors, many acid, some direct colors, some sulfuric acid esters of leuco vat dyes, as well as some naphthol, basic, and oil soluble colors which latter three groups may or may not be in Class I as well.

CLASS III

This class includes dyes which have an affinity for the surface of "Vinyon" due

* Presented at meeting, Philadelphia Section, March 1, 1946.

to their polar structure. An example of this class is Rosaniline Base, Colour Index No. 677. It will be seen from inspection of the formula of this base that the part of the molecule containing those groups responsible for its color may exist in solution as a complex cation. This cation is thought to be strongly adsorbed on the surface of the "Vinyon" filament. A few of these dyes may also fall in Class I and all so far as tested are to be included in Class II. Having included all common dyes in general classifications, the following discussions deal with the application of each type of dye within these classes.

ACETATE DYES

All direct dyeing acetate dyes tested have been of Class II. At the present time, acetate dyes are those most commonly used to dye "Vinyon." By themselves in a water dispersion some will dye to very light shades of inferior wash fastness on the surface of the yarn. However, by use of "assistants" quite deep shades can be dyed which are characterized by moderate to poor fastness to light, rubbing, and washing. Penetration of the yarns is generally poor but the exposed surface is quite levelly dyed. The comparative simplicity of the method and the wide range of colors possible, as well as the lack of methods of application of fast dyes in the past, have been the reasons for their adoption.

Typical selected chemicals which are used as "assistants" are ortho-hydroxy diphenyl (Dowicide No. 1), dibutyl phthalate, and a "Vinyon Dyeing Assistant" manufactured by Onyx Oil & Chemical Co. These choices of "assistants" have been narrowed down from many chemicals, most of which were either too expensive, toxic, flammable, water soluble, or otherwise objectionable. There may well be, however, other "assistants" more effective than these but which have thus far escaped detection.

The "assistants" affect the sensitivity of the dyeings to detect uneven stretching of the yarn which sometimes occurs in manufacture.

The use of ortho-hydroxy diphenyl in general shows less sensitivity than the other two previously mentioned. Another fault with these "assistant" dyeings is that dye is left in the surface of the "Vinyon," and when this dyed "Vinyon" is placed in contact with other materials having affinity for the dye, migration of certain dyes will take place at room temperatures. Dyed filaments under the microscope show only the outer surface dyed with very little penetration within the dumbbell shape filament. This surface dyeing has been a necessary characteristic of "assistant" dyeing for the reason that if the "assistant" were allowed to penetrate to the core of the "Vinyon" filament, permanent damage would result. There have been indications that if the chemical used as "assistant" to be selected for low molecular weight, then better penetration may be obtained than with large molecular weight chemicals.

The mechanism of dyeing "Vinyon" with acetate dyes by the "assistant" method is largely a phenomenon of preferential solubility. Substantivity, a term understood to cover several complex actions in the case of direct dyes on rayon, has not been detected. Both the solvent method and the "assistant" method are basically the same, involving a swelling of the surface of the "Vinyon" by a solvent for "Vinyon" and simultaneously allowing dye to enter. Once within this "Vinyon" surface mix, the dye is trapped by removing the cause of the swelling, and is held in its position in this modified surface. The solubility of the dye itself in "Vinyon" alone is not usually an important factor since it is exhibited only to a very slight degree by most acetate dyes. This may be checked by showing that there is no diffusion of an acetate dye such as Eastman Blue BNN when an undyed swatch is placed in contact with dry dye for long periods at 135°F.

To explain the difference between "assistant" and "solvent" dyeing is merely to show that they are essentially one and the same, only differing in the proportions of chemicals used. In the case of an "assistant" dyeing in a water dispersion, the dispersed globules of "assistant" will rapidly remove a major portion of the dye from the water phase. Exhaustion of the dye bath commences when these dye "assistant" globules come in contact with the "Vinyon." When this takes place, these globules exhibit little tendency to return to the water dispersion. Therefore, the equilibrium between dye in the dispersion and dye on the fiber appears to be reached when the "assistant" held by the "Vinyon" has absorbed all the dye which is soluble in it or when the "Vinyon" has absorbed all the "assistant" dye mix which is soluble in the "Vinyon" at that temperature. These dye "assistant" globules may be said to be a "solvent" dyeing within a water medium. By this is meant that since neither the dye nor the "assistant" nor the "Vinyon" is soluble in water, the water has no part in the dyeing beyond supplying a means by which a relatively even application of solvent and dye can be made to the "Vinyon." To illustrate this closeness of relation between the two methods: A dispersion of 15% of butyl formate on the weight of "Vinyon" can be used as an "assistant" for dyeing. Again butyl formate can be used effectively in a solvent dyeing. In this case, sufficient alcohol is added to maintain a solution in water instead of a dispersion. The concentration of butyl formate used in such a solution is 25% by volume. In these cases, neither the water or the alcohol have a swelling effect on the "Vinyon."

The following points are important in "assistant" dyeing:

(1) The "Vinyon" filaments must be swollen as much as possible without causing excessive shrinkage. In general, 5%-10% by weight of "assistant" to "Vinyon" is used in a water dispersion.

(2) In the case of "assistant" dyeing the depth of shade will increase with increasing dye solubility in the "assistant," and decrease with increasing dye solubility in the dispersing medium.

(3) For a given amount of "assistant," the depth of shade will tend to vary inversely with the solubility of the "assistant" in the dispersing medium.

Examples are given here to illustrate these three points:

(1) In a dispersion in water, 3% Igepon, 8% ortho-hydroxy diphenyl, and 5% Eastman Blue BNN on the weight of "Vinyon" (HST), a very weak depth of dyeing will take place at 80°F. At 110°F. a definite increase will be noted. At 130°F., a full blue shade will be dyed with approximately 2 to 4% shrinkage. At 140°F., the depth of shade is still more increased but is accompanied by a shrinkage of 15 to 20%. These dyeings illustrate the rate of dyeing as influenced by the swelling of the "Vinyon" since the amount of ortho-hydroxy diphenyl adsorbed from the dispersion increases with increasing temperature.

(2) In a series of dyeings on "Vinyon" using as "assistant" constant percentages of:

a. ortho-hydroxy diphenyl
b. "Onyx Vinyon Dyeing Assistant"
c. di butyl phthalate

With dyestuff Celliton Blue Green BA:

a. Dyes to about 80% depth of (b)
b. Dyes to a medium blue
c. Dyes to about 40% depth of (b) in a blue green shade

With Cibacete Scarlet BRN:

a. Dyes to about 60% of (c)
b. Dyes to about 60% of (a)
c. Dyes to a medium rose shade

With Cellutate Brilliant Blue B:

a. Dyes to a bright blue

b. Dyes to about 50% of (a)
c. Dyes to about 50% of (a)

These are illustrative of the effect of variations in solubility of the dyes in varying "assistants."

(3) For a given amount of "assistant," the depth of shade of dyeing will vary with the solubility of the "assistant" in the dispersing medium. As an example, it can be shown that substitutions of alcohol for water in an aqueous dispersion containing 5% ortho hydroxy diphenyl on the weight of "Vinyon" will decrease the depth of dyeing until such a point that the dyeing will be no heavier than without any "assistant."

Example of dyeing with acetate dyes by use of "assistants."

5% of ortho hydroxy diphenyl on the weight of the "Vinyon" HST is placed with 3% Igepon and 5% dissolved gelatin in ¼ the volume of water to be used in dyeing and brought to 205°F. and held at this temperature for five minutes. The dispersion is then allowed to cool for a few minutes and cold water added to bring the bath to volume. 5% Celliton Fast Brown 3RA, well dispersed and strained, is then added. The goods are then entered and the temperature of the bath raised to 130°F. and run ¾ hour at 130°F. The liquor is dropped and the goods are scoured in a soap and soda ash bath for ½ hour at 130°F. followed by rinsing and drying.

This dyeing is fairly fast to crocking and washing but has rather poor fastness to light. The gelatin is used to make the ortho hydroxy diphenyl dispersion more stable which in turn appears to improve the crock fastness somewhat.

The following dyes have been selected for suggested use. The fastness to crocking is usually best with the dibutyl phthalate and the "Onyx Assistant." The fastness to light and levelness of dyeing is normally superior with the ortho hydroxy diphenyl.

Some of the dyes which exhibit gas fume fading on cellulose acetate materials appear to exhibit a like tendency in this direction when dyed on "Vinyon." In a prolonged exposure to gas fumes a slight darkening or dulling of the shade has been apparent. It has not been proven whether this will take place in actual practice or whether it is a fault only seen in gas fume testing.

SRA Yellow XII
Eastone Yellow 5G
Cibacete Yellow 2RN
Setacyl Direct Blue GD
Celliton Fast Purple D
Celliton Fast Brown 3RA, 3RN
Eastman Blue BNN
Celliton Fast Violet 6BA
Celliton Fast Black BTNA
Cibacete Navy Blue BRR
Cellutate Brilliant Blue B
SRA Navy Blue B
Acetesol Fast Crimson B
Calconese Red PYC
Celliton Fast Pink RF
Celliton Fast Red BBN
Red 3B
Cibacete Scarlet G—an orange brown shade
Solacet Fast Red BGS—brownish red
Solacet Fast Yellow GS
SRA Yellow G

Proceeding along the lines used in dyeing acid dyes on cellulose acetate materials in water mixes with water soluble swelling agents on solvents showed that those acid dyes normally used for this work had no apparent affinity for "Vinyon," but that acetate dyes could be effectively substituted. A solvent mixture consisting of 27% by volume of ethyl acetate, 38% of denatured alcohol, and 35% of water will dye bright full shades on UST or HST "Vinyon." Three to five minutes immersion at 80°F. followed by an immediate rinse is all the dyeing required. In general, the same dyes which are used in "assistant" dyeing can be used in solvent dyeing. In this manner better penetration of both fabric and filament can be obtained with improved fastness to rubbing and washing. The fastness to light is sometimes better than that of the same dyes dyed with "assistants," since the more volatile solvents can be more completely removed from the material. The ethyl acetate may be substituted by other suitable solvents to give increased solvency for particular dyes. Control of temperature and of time in this type of dyeing is very critical. These two facts coupled with the short supplies of alcohol during the past few years, have retarded further development. Moreover, uneven stretching during manufacture of the yarn is severely emphasized and presents a disadvantage to the method.

THE APPLICATION OF DIRECT COTTON OR RAYON DYES

The majority of direct dyes fall in Class II. In water solution with or without "assistants" present, these dyes have shown little if any tendency to dye "Vinyon." Even though the "Vinyon" be swollen by an "assistant" in which the dyes are quite soluble, the dyes will not leave the water phase and enter the "Vinyon" "assistant" mix. These dyes may be said to act on "Vinyon" under these conditions as they would on cellulose acetate when no swelling agents have been added. However, in the case of cellulose acetate the addition of ethyl alcohol to a water solution of the direct dyes will in many cases allow them to dye. On "Vinyon," as long as water is present in amounts greater than 5% by volume no dyeing takes place in spite of any swelling agent tested to date. However, if to a solvent such as the mono ethyl ether of ethylene glycol containing no added water, 1 to 2% of dye be dissolved, the resulting liquor will dye full bright shades on "Vinyon" with such dyes as Benzo Fast Orange WSA, Pontamine Turquoise 8 GL, Benzo Fast Black L, etc.

The first action of the 100% Cellosolve appears to be to swell the resin by entering in its surface and causing an increase in bulk. Apparently at the time that this imbibition takes place, the dissolved dye is either carried in along with the solvent or can be considered soluble in the "Vinyon" Cellosolve mix. Extending the period of time of immersion of the filament in the solvent or raising the temperature will bring about eventual destruction of the yarn.

Addition of 10% by volume of water will prevent dyeing from taking place. At any one temperature the amount of Cellosolve absorbed by "Vinyon" in a given time decreases rapidly with increasing dilution of the Cellosolve with water (at temperatures below those at which "Vinyon" would be softened in a water bath). However, by raising the temperature the "Vinyon" can be swollen by absorption of the Cellosolve but no dyeing will take place so long as 10% by volume water is present.

Example:

A 2% solution of Diphenyl Blue GLN in ethyl Cellosolve at 100°F. will dye UST "Vinyon" in five minutes to a full blue shade. Rinsing in water after dyeing apparently removes the Cellosolve from the surface of the material and makes the yarn less plastic. It may then be extracted and then dried at 140°F. for 30 min. until the Cellosolve is removed. A shrinkage in length of from 10 to 15% takes place during drying unless held under tension. The resulting dyeing after the rinsing to remove surface solvent and dye, is very fast to soaping and the fastness to sunlight is comparable to the fastness of this dye on viscose rayon or cotton. The comparable degree of light fastness of direct dyes on "Vinyon" varies widely from the fastness of the same dyes on viscose rayon or cotton. In some cases it is reduced to a few hours exposure while in other cases it appears to have greater fastness than on the cellulose materials.

ACID DYES

The water soluble acid dyes are in general like the majority of the direct colors. An appropriate solvent can usually be found which will allow their use in dyeing "Vinyon" in the same manner.

Dyeings made in ethyl Cellosolve with dyes such as Alizarine Supra Blue A, Polar Red RS, Polar Brilliant Blue GAW, Gycolan Black WAL, Calcocid Blue Black and others in medium to full shades have shown good fastness to light in 50 hour exposures in the Fadeometer. These dyeings after rinsing with warm water show no crocking and are uneffected by strong soap solutions. Apparently as in the case with direct rayon dyes which are also water soluble all surface dye is easily removed and the remaining dye protected by being sealed in the "Vinyon" is not touched by water or soap or mechanical rubbing. No apparent tendency has been shown by these dyes to migrate to the surface of the "Vinyon."

Example:

One pound of UST "Vinyon" will remove approximately 25% of the dye present in 8 pounds of a 2% solution of Calcocid Blue Black in ethyl Cellosolve when immersed for a period of five minutes at 100°F. Since not more than 8-10% of the solvent present is actually within the "Vinyon" at the same time, it is evident that an equilibrium between dye-Cellosolve and "Vinyon"-dye-Cellosolve is only established after considerable dye in excess of a 2% solution has been held within the "Vinyon." Neither dry or water wet dye shows an affinity for or solubility in "Vinyon" when held in contact over protracted periods, therefore, it may be assumed that once inside the solvent swollen "Vinyon," the dye is held by some force which is not apparent on the surface of the material before swelling.

In the Cellosolve solvent dyeings, the UST yarns may be dyed in loose skein form without shrinkage changing the characteristics of the yarn too much for practical usage. However, the HST yarns are so affected by the large take up of solvent that the resultant shrinkage if allowed to take place will lower the strength and increase the elongation. The use of a constant light tension on the yarn during the process tends to prevent this deformation.

VAT DYES

When applied to "Vinyon" from pigment or reduced water baths, these dyes ordinarily exhibit very little affinity. However, a patent was issued [7] on such an application of the dye using "alkali metal free nitrogen bases" in the reduction and usually including swelling agents for the yarn. This application method would tend to place these dyeings in Class II.

The writer has been able to increase the depth of shade of normal vat dyeings as well as water applied direct and acid dyes by pretreatment of the yarn with cationic materials. The result is a surface dyeing with rather poor fastness to crocking and soaping.

With the sulfuric acid esters of these vat dyes, however, it is possible to dye "Vinyon" again by the solvent method as discussed under direct and acid dyes. In this case, the oxidized dyes are not water soluble and therefore, strong mechanical soaping action is required for the removal of surface pigment. Indigosol Blue AGG is an example of a dye easily soluble in Cellosolve which may be applied from this solvent. Applications of vat dyes by methods used by the writer have resulted in general in dyeings of inferior light fastness.

SULFUR DYES

At present, dyeing with sulfur dyes is to be compared with vat dyes in affinity for "Vinyon" when applied in the usual methods used for dyeing cotton or rayon. The same patent of Petke & Klein[7] claims good dyeings by means of swelling agents and "alkali metal free nitrogen bases" as aids in dyeing.

NAPHTHOL DYES

The application of naphthol dyes can be carried out in a similar manner to that which has been sometimes used on cellulose acetate and nylon. This would apply to those bases and those naphthols which fall in Class 1. The base and the naphthol are put together in a water dispersed bath and are absorbed by the "Vinyon" due to their solubility in the "Vinyon." When coupled in warm sodium nitrite and acetic acid, medium heavy shades can be obtained. (The depth of shade usually falls just short of producing a good black or navy blue.) Exhaustion of the dye bath is poor and would probably require a standing bath of naphthol and base to be commercially feasible. Light fastness varies from good to poor and the crocking fastness is comparable with dyeings made with acetate dyes. However, the dyed fabric is well penetrated giving the naphthol dyes some advantage. In some cases, the naphthol or base, or both, may fall in Class II only and "assistants" can be used to produce dyeings in a similar manner to those of direct acetate dyes. The lack of penetration of a fabric is then immediately noticeable.

Again the naphthol and bases can be applied by dissolving in Cellosolve and dyeing the "Vinyon" in this liquor with short time exposure, finishing up after a water rinse with a nitrite and acetic acid bath.

In all these procedures, it is necessary to work out proper proportions of base to naphthol because of varying solubilities of either part in the "Vinyon" itself. The light fastness and migration fastness is badly affected by any considerable uncoupled excess of either naphthol or base. The crocking fastness is improved by thorough rinsing before diazotization. It is peculiar that the coupling takes place at all when the water absorption of "Vinyon" is considered. This absorption is about 0.1 per cent and therefore the penetration with the nitrite and acid would appear to be difficult. Cross sections of filaments viewed under the microscope show complete penetration of color when using the Class I naphthols and bases.

BASIC DYES

All basic colors tested to date would be placed in Class III and Class II in their behavior towards "Vinyon." As a group they are easily applied from a water medium with or without "assistants." When dyed without "assistants" the basic tri phenyl methane dyes usually display fair exhaustion from the dye bath, the other basic colors showing in general less exhaustion. The "Vinyon" is literally plated with the dye which has little fastness to rubbing, washing, or light. When applied by the use of "assistants" the washing and rubbing fastness is improved while the light fastness remains poor. The best method of applying heavy shades with basic dyes is by use of the same type solvent method used in applying acetate dyes. The crocking and washing fastness of dyeings made in this manner is much superior to that of the same dyes applied either by direct or "assistant" methods. Janus Black I is one basic dye which shows good light fastness in solid black shades on "Vinyon."

At this point, it may be mentioned that application of certain resins may be used to improve crocking results on any dye showing this defect. Padding through a 5.0 per cent dispersion of Rhoplex MR, followed by careful drying will tend to minimize crocking.

OIL SOLUBLE DYES

Oil soluble dyes on "Vinyon" materials very often show a tendency to migrate from the "Vinyon" to other materials in contact with them. This is exhibited very strongly in the migration of dye from samples filed in envelopes to the paper surfaces which are in contact with the samples. For the reason of migration alone these dyes would not be very satisfactory.

(Continued on Page P204)

ELECTRONICS IN TEXTILE TESTING*

E. R. SCHWARZ, F. T. I.

Professor of Textile Technology; In Charge Textile Division, Massachusetts Institute of Technology

THE Eastman Research Laboratories at the Massachusetts Institute of Technology have prominently displayed in the entrance lobby a bronze plaque bearing this inscription—

> "Gross gravitating matter is responsive to energy consisting itself of aggregates of energy revealed in its innermost structure by the study of radiation from which both matter and energy at last seem fully undistinguishable."

This is one way of stating the importance of electronics. In less striking terms, a recent book[1] on the subject states —"Electronics is that branch of science which describes the properties and control of electrons, and other rudimentary particles, which in correlation with energy, constitute matter." These definitions naturally raise the question, "What is energy?", and in turn energy may be defined as the agency by which matter is united, disintegrated, or displaced.

It is hardly necessary to tell chemists that energy is involved in a chemical union for the making of a compound. That is, uniting something with something. Further, anybody who has read the newspapers in the last few months knows about the disintegration of the atom—releasing atomic power. It is known from personal experience in getting in and out of a room, that the amount of energy taken to displace one's own physical entity is definitely a measurable quantity. Energy is required to move anything.

Now, electronics could just as well have been called mesotronics, protonics, neutronics, or half a dozen different names because these other names would have to do with "the other rudimentary particles" —those other little bits of energy which are not perhaps as active as electrons or as active for so long a time, but *are* building blocks which constitute matter.

The three principal building blocks of which all matter is composed are electrons, protons, and neutrons. But the electrons are the most active and by far the most interesting; sometimes most elusive; and probably by far the smallest and lightest. Giving them due credit on all scores, the new science has been called electronics.

Imagine a tube which has been evacuated and which has then been filled with a small amount of gas. Suppose an electrode is inserted at one end and another electrode at the other end and both sealed in. Now impress a voltage across these electrodes. Something flows from one electrode to the other, and if a small target is placed inside the tube between the electrodes, a shadow of the target will be cast on one end of the tube. Something must be flowing through the gas and flowing in one direction only. A stream of electrons is actually moving in the tube from one place to another and in doing so, electrons are colliding with molecules of gas. The electrons themselves are light and small and are traveling approximately at one third the speed of light (something over 60,000 miles per second). They bump into a number of gas molecules and something happens. There is an interchange of energy and lower frequency vibrations are set up—so low they become visible (light) and another type of little body is given off, a particle of energy called a photon which is just another word for visible light.

Now, if a plate of metal were to be substituted for just a plain wire electrode and if a hole were to be drilled through the center of the plate and an evacuated tube fastened to the rear of that hole, a stream of small particles of energy would be found going in the opposite direction to the stream of electrons. It would be found to be moving much slower than the electron stream, and if a magnetic field were to be applied, the stream would be deflected in the opposite direction. If the direction of deflection of the electron beam is taken to represent the behavior of negatively charged particles, then this latter stream of particles must be positively charged. Thus it is to be expected that they might be called protons, and so they are. This type of tube is the ancestor of the cathode ray tube; used for the oscillograph as well as for radar. Protons, then, are heavier than electrons and are positively charged. The electron is negatively charged. Naturally, therefore, they should be attracted. They do not merge ordinarily because the proton forms the core or the nucleus of the atom, while the electron whirls madly around it, much as the planets are revolving about the sun in the solar system. If a proton about the size of a baseball is assumed, then the electron would be a speck revolving some two thousand feet away from it, and traveling so fast that it can defeat the pull of a positive attraction. Thus, a stable atom is created which is dealt with in chemistry and which is recognized as being stable until an unkind physicist splits it. In the case of a hydrogen atom, there is a nucleus made up of a proton with an electron flying around the outside at a speed of about four thousand miles per second.

Occasionally a proton and an electron do merge. When they do, the charges are neutralized and a neutral particle—called a "neutron"—is produced. Thus, there are the electron, the proton, and the neutron, forming the building blocks of which all matter is made. Helium is made up of a nucleus consisting of two neutrons and two protons with two electrons flying around it. There are also other rudimentary particles that occur for a few millionths of a second and are then changed into energy or back to matter again. Certain of them have a mass similar to that of the electron, but they are positively charged and are called positrons. They result from cosmic ray bombardment of matter. There is also the mesotron which is sometimes positive and sometimes negative and is slightly heavier than the electron.

Finally, there is the spontaneous disintegration of radio-active material of which radium is an example. Upon such disintegration, a discrepancy in the energy evolved occurs which has not been accounted for except upon the hypothesis of still another sort of energy particle—the neutrino. This particle has not yet been isolated. In this disintegration there are also formed alpha, beta, and gamma rays. The alpha rays are really high velocity helium nuclei made up of protons and neutrons. The beta rays are made up of electrons, positrons or a mixture of both and travel with the speed of light. The gamma rays are radiant energy at the

* Paper presented before the Northern New England Section, October 19, 1945 and before the Rhode Island Section, November 23, 1945.

visible level or slightly beyond and a unit or *quantum* of this radiation is known as the photon.

As the chemist recognizes a reversible reaction, so in electronics there is a similar phenomenon. Electron beams striking certain chemicals produce beams of photons, as from the fluorescent screen of the oscillograph. On the other hand, a beam of photons striking certain chemicals produces a stream of electrons—an electric current. This is the action which takes place in the photo-cell. Thus, electric current may be changed to light or light to electric current. Photo-cells are used to open and close doors, to keep cloth straight in a tenter, to sort one type of object from another, to measure light intensity, and to operate textile testing equipment.

As has been noted, when elctrons bombard certain gasses, light is given out. Two such light sources are employed in connection with textile microscopy. One is the high pressure mercury vapor lamp which is a powerful and compact source of ultra-violet light for work either in fluorescents or for the ultra-violet microscope itself. The other is the newly developed fluorescent lamp which is an excellent source of light, both for visual work with the microscope and for use in the preparation of photo-macrographs. The problem of photographing textiles at low and medium powers with the micro-tessar lens is complicated by the long exposures required with the usual lights which overheat or burn the material. The fluorescent lamp (Fig. 1), on the contrary, furnishes light of sufficient intensity and actinic quality to make the usual exposure but a fraction of a second, and to offer no danger whatever of overheating—no matter how long the light is thrown onto the specimen. The equipment also has the advantage of ready availability and cheapness, both of first cost and of maintenance. Only 60 watts are needed to do the work which would otherwise be accomplished by a 500 watt bulb of the conventional projection type. Excellent results are obtainable photographically as is evident from Fig. 2.

Another device increasingly useful in textile testing is the thermocouple. For the measurement and specially for the recording of temperatures or for the control of temperature, this is really a means for converting thermal energy into electronic current. Such a current is simply a flowing of elecrons; hence, is electronic. A specific use in textile testing is in the Cenco-Fitch heat conductivity equipment for measuring the insulating power of fabrics.

As will be pointed out in more detail, the oscillograph and the electron micro-

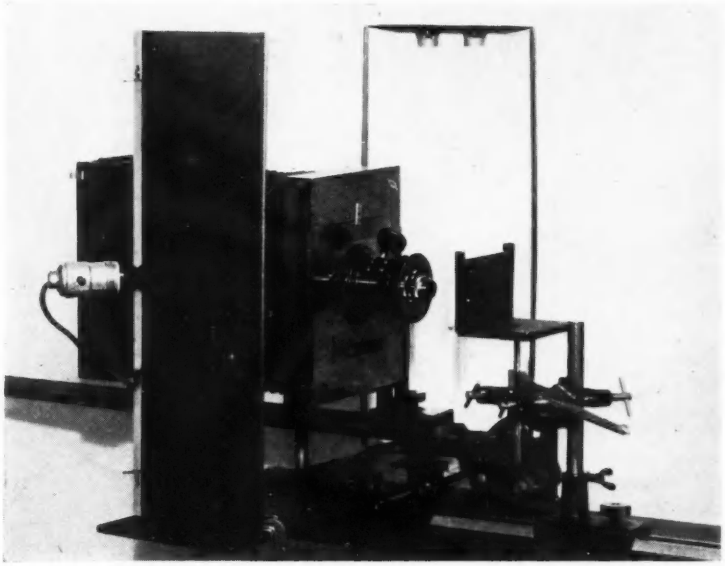


Figure 1 *M. I. T. Textile Division Photo*
Fluorescent Lighting for Micro Tessar Lens Photomacrography. (See Figure 2.)

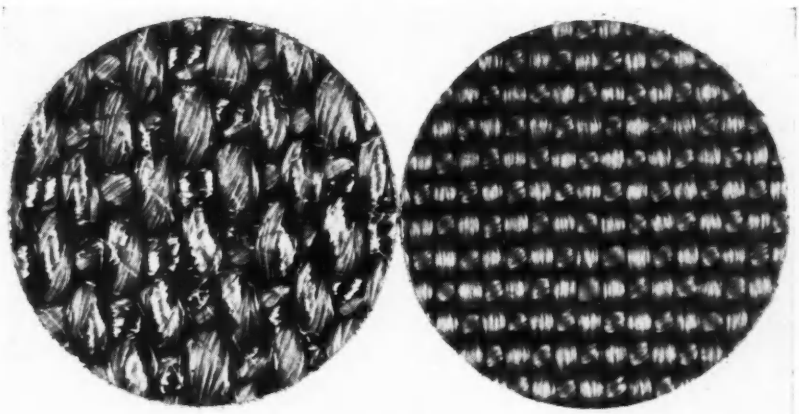


Figure 2 *M. I. T. Textile Division Photo*
Fabric Photomacrographs taken with the Apparatus of Figure 1.

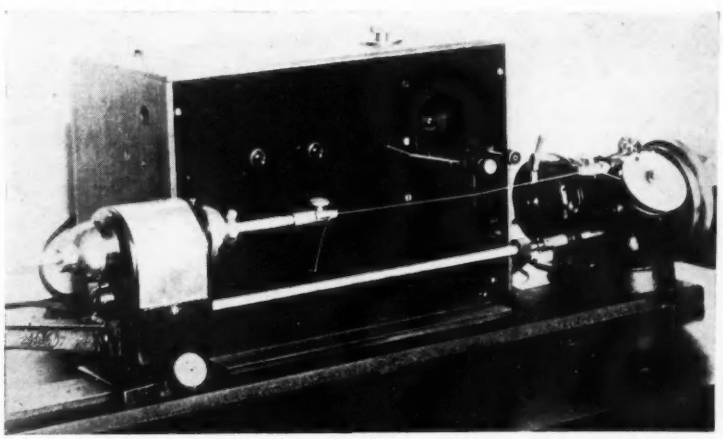


Figure 3 *M. I. T. Textile Division Photo*
Photo-electrically operated Twist Tester for Single Yarn.

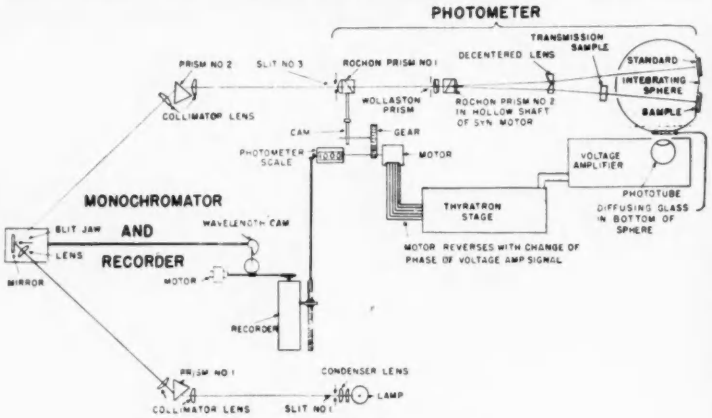


Figure 4
Hardy Spectrophotometric Color Analyser.

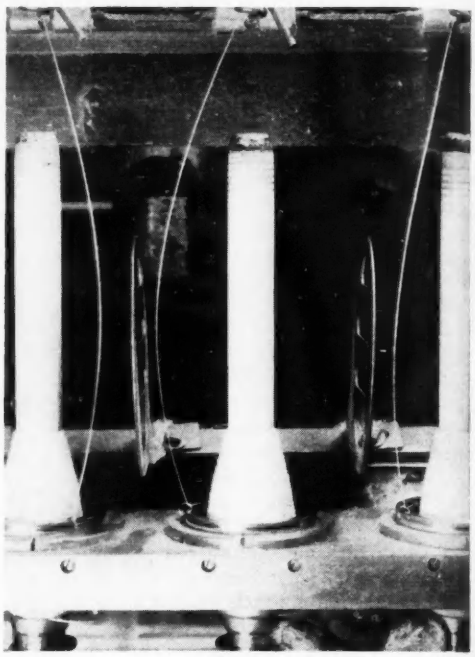


Figure 5 *Edgerton Photo*

scope are instruments in which a beam of electrons in a vacuum is directed in its motion by means of magnetic fields; in the one case to produce a record of the nature of the electrical phenomenon fed into it, and in the other, to produce an image of a specimen at tremendously increased magnification and resolution over that possible with the visible light microscope. Where the latter is effective efficiently up to about 1200 diameters, the electron microscope is being used daily at from 50,000 to 100,000 diameters. Still another invaluable means for studying ultimate fiber structure is the X-ray diffraction apparatus.[2] Here a beam of electrons, traveling at high speed, is diffracted by the layers of atoms composing the repeating pattern of the architecture of the fiber to form a characteristic pattern on a photographic film.

Conversion of light to electrons (electric current) is brought about by the photo-electric cell or tube. This device is the basis of the Hertel Fibrograph[3] which produces a diagram indicative of the frequency array of staple length of cotton fiber. The simple photometer also employs the photo-electric cell to indicate in terms of electric current produced, the intensity of the beam of light striking the cell, so that definite and simple measurement is possible. The same principle is employed in analyzing the diagrams showing the variation in the diameter of yarns by whatever means the latter may have been produced. The diagram is used to vary the amount of light striking a slit and passing through it to impinge upon the sensitive surface of the photo-cell. In the improved M.I.T. single yarn twist tester[4], a photo-cell is used to control the operation of the motor which drives the unit. (Fig. 3). A beam of light is passed from a source through a slit to a photo-cell. Between the source of light and the cell is a vane delicately balanced on a counterweighted arm, which weighs only a fraction of a gram. As the yarn changes in extension or contraction due to the removal or addition of twist, the vane will be raised or lowered to allow free passage of the light to the photo-cell or to prevent any light from reaching it. Since the beam passes through a very narrow slit, only a very slight motion of the vane is required either to start or stop the action of the cell and consequently the rotation of the motor which is driving the twist tester. With this device, the human equation is very largely eliminated and a number of advantages in operation are possible. The method of test is essentially that recommended by the American Society for Testing Materials. In a single filament tension tester devised by Harris and Fourt, photo-cells are used in connection with a beam of light to control the operation of the jaws of the tester so that a chart giving load versus deformation may be obtained automatically.

A vacuum tube is a device for utilizing a stream of electrons to change alternating current to direct current; to detect electro-magnetic waves; to amplify electrical signals; or to turn on or off an electrical current with extreme rapidity. Frequently such a tube, as an amplifier, may be used with a photo-cell to build up the signal generated by the cell to sufficient strength to operated some other device such as a motor. This is the principle used in the Hardy Spectrophotometric Color Analyzer. (Fig. 4). Here a photo-cell looks into an integrating sphere, and as a beam of monochromatic light is polarized, split, and thrown sixty times a second, first onto the standard and then onto the sample, generates a very weak 60-cycle alternating current if the intensities of the reflected beams are different. Vacuum tubes are used to amplify these signals until they are powerful enough to operate a motor which controls the relative intensity of the beams which are thrown alternately on sample and standard. The motion of a motor-driven cam not only varies the position of a polarizer which cares for the intensity of the light beams, but also moves a pen across a chart. The motion of the pen is proportional to the relative reflectance of the sample with respect to the standard, and if now the chart is moved in proportion to the motion of a slit which transmits the monochromatic light beam, one wave length at a time, from a spectrum produced by a prism, a diagram representing the reflectance of the sample from one wave length to another continuously across the spectrum will be drawn.

A combination of vacuum tubes and condensers makes possible the Edgerton high-speed photograph, with exposures of the order of 1/2,000,000th of a second, this powerful light can be used with the ordinary camera to analyze even the most rapid movements. A spinning frame spindle running at 9600 revolutions per

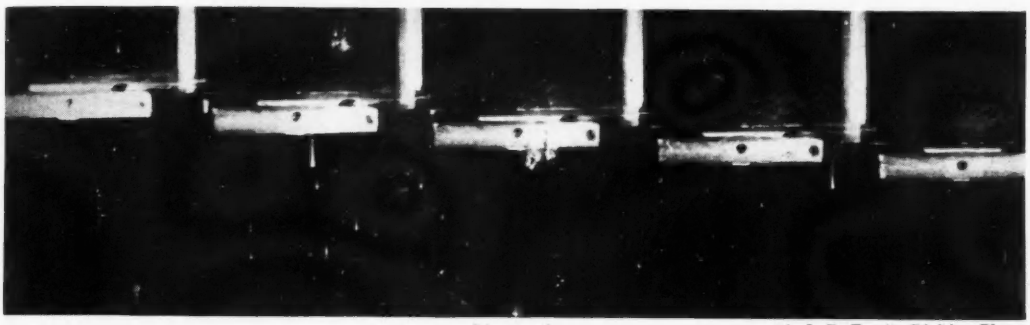


Figure 6 *M. I. T. Textile Division Photo*

High Speed Photo of Falling Weight of Slater Impact Tester, as it Strikes the Lower Jaw. (Five Successive Positions Shown.)

minute can be "stopped" in such a flash-photo and appears as in Fig. 5. The falling weight of the Slater impact tester, Fig. 6, is also shown by multiple flashes of extremely short duration as it strikes and carries along with it the bar carrying the lower jaw of the machine. The interval here is about 1/12,000 of a second. (See also Fig. 12).

Such devices as the Saco-Lowell sliver tester, measures the variation in linear density of sliver and of rovings. It is essentially an accurately mounted and power-driven grooved wheel of about 10 centimeters diameter, together with a tongued wheel mounted an a weighted lever and adapted to compress the material into the groove of the main wheel. The lever which carries the follower wheel is coupled to a magnifying lever system and to a chart and pen mechanism in such a fashion that variations in its position with respect to the main wheel groove, and hence variations in bulk of the material pressed in the groove, will be recorded in a continuous graphical form in synchronism with the passage of the sample through the instrument. The resulting charts indicate variations fairly well, but are difficult of quantitative interpretation, in particular as to the determination of an average value and the standard error of this average. Furthermore, the standard deviation of individual readings from the mean is an important factor in the interpretation of the results. In order to obtain a rapid method for evaluating these diagrams as they are drawn, the Deviometer was developed by Vose and Plummer[5] recently. In this device, a rotatable coil is so adjusted that it stands parallel to the magnetic flux of an alternating magnetic field furnished by a pair of symmetrical coils fed from a sixty-cycle power line through a voltage regulator. When the evenness tester is in its center position and adjustment is made to make this correspond with the approximate average thickness of the material being tested, the coil will be rotated a small distance in one direction for a thin spot and a small distance in the other direction for a thick spot and will therefore pick up a sixty-cycle signal voltage in proportion to the sine of its angular motion. If the mechanism is so designed that the angular motion of the coil is very small, even at its limiting position, it may be assumed that the sine of the angle does not differ appreciably from the angle itself and that, therefore, the signal voltage which is picked up by the coil, will be directly proportional to the motion of the follow-up wheel and hence to variations in bulk of the material under test. The authors show that it is possible to set up an expression for the standard deviation which will be in the form of the square root of the difference of two integral ratios, one of which is squared. These integrals are functions of time and therefore electrically it is possible to integrate the first power of the variable by energizing one coil of a watt-hour meter. To determine the squared term, it is only necessary to energize both coils with the same signal voltage directly proportional to the variable. Recording dials, then, give the necessary information. Eight vacuum tubes are required in the electrical circuit for proper functioning of the instrument.

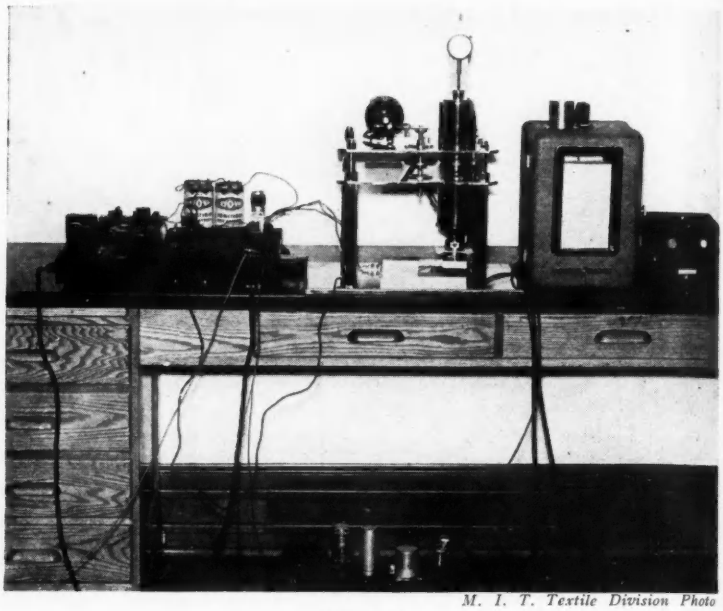
In certain work involving textile fibers, it is definitely a fact that the deformations are proportional not only to the loads applied, but also to the time over which the load acts. Under these conditions, the measurement of the modulus of elasticity becomes difficult since it is complicated by the presence of creep phenomena. In order to obtain an instantaneous modulus[6] which will be free from these time effects, it is essential that the load be applied extremely rapidly. Because of this rapidity of application, vacuum tubes are of considerable assistance in both the control and in the production of the required oscillations. The vacuum tube oscillator is provided to set up audio waves or sound waves in a sample which is of known length and under known tension. A crystal detector can be moved along the sample and determines the peaks and valleys of the waves thus established. Signals from the detecting crystal are amplified by a series of vacuum tubes and the signal is fed to a meter which then gives indication of the location of the peaks of the waves. If the velocity of sound is set equal to the frequency of vibration multiplied by the wave length and also to the square root of the modulus of elasticity divided by the density of the medium, it is possible to evaluate the instantaneous modulus by measurements of the factors which have this under control.

One difficulty in the operation of the usual pendulum type testing machine for tensile tests is that the pendulum principle involves a non-uniform rate of load application. This is complicated by the fact that even though the stretching jaw moves at a substantially constant rate, the actual stretch of the specimen at any instant is the difference in motion of the stretching and the loading jaws. Since the loading jaw is moving of necessity non-uniformly, it follows that this machine impresses neither a constant rate of load nor a constant rate of stretch upon the specimen. Thus, orientation effects and uniformity of results leave much to be desired. The General Electric Company[7], working with Scott Testers, Inc., have developed an electronic means of controlling the operation of the usual pendulum type tester so that the rate of load application is maintained constant throughout the test. In order to make this device effective, it is necessary to use three vacuum tubes in the system; one of these is a rectifier, one a phase-control tube, and the other a thyotron for control of the motor which drives the machine. A Selsyn is connected to the torque balance shaft behind the load-indi-

M. I. T. Textile Division Photo

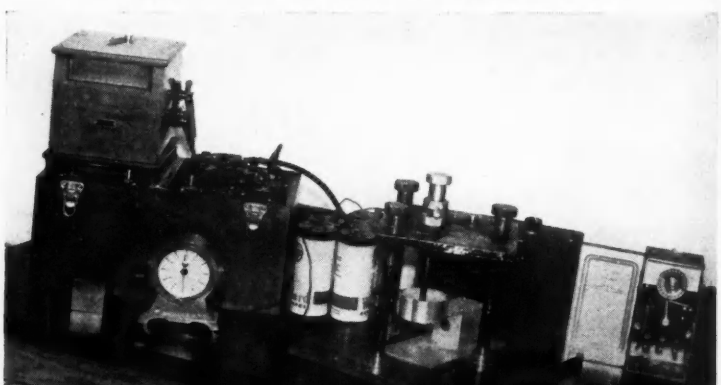
Figure 7
Interior of Dielectric Test Unit. (Note Vacuum Tubes.)

cating dial of the pendulum type tensile tester and will thus be rotated through some angle as the pendulum swings. Essentially, if the sine of the angle of swing of the pendulum can be made to increase at a constant rate, the loading rate will be constant. It is an inherent characteristic of the Selsyn that as its rotating member is turned through an angle, a continuous voltage signal proportional to the sine of the angle of rotation appears at the motor winding terminals. This signal is received, rectified, filtered, and then passed in sequence through a capacitor and resistor. Now, the magnitude of the current varies as the product of the capacitance and the rate of change with time of the Selsyan signal voltage impressed on the capacitor. The capacitor is fixed and the value of the rate of change of Selsyn voltage is determined by the rate at which the pendulum swings through its arc—that is, the rate of increase of the sine of the angle of swing. In passing through the resistor the current causes a voltage drop to be established of magnitude directly calculable from Ohm's law. This voltage, in turn, is impressed upon the grid of a phase-control tube of a standard electronic motor-control circuit. The speed of the



M. I. T. Textile Division Photo

Figure 8
Compressional Resilience Tester for Cyclic Operation.



M. I. T. Textile Division Photo

Figure 9
Bulk Fiber Resilience Tester.

M. I. T. Textile Division Photo

Figure 10
Load Relaxation (Creep Apparatus) at Constant Deformation.

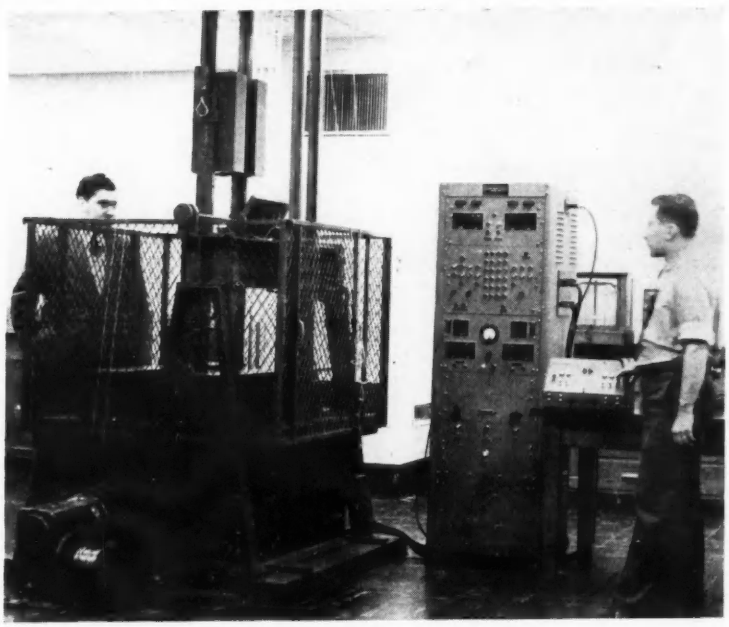
direct current driving motor is thereby controlled. By setting a calibrated dial, the operator may select the desired loading rate and establish the anode to cathode voltage on the phase-control tube. Since the time required for the completion of the entire sequence necessary for the control of the motor speed is of the order of a few cycles and the system is operating at many cycles per second, a very sensitive and smooth control is possible.

Still another use for electronic devices is in the production of a unit for dielectric heating. Many textile materials are thermo-plastic or can be treated with thermo-plastic resins so that it is possible to fuse units of structure together by heating. This heating may be produced by infra-red radiation, by the direct action of a heating oven or other device of more usual character, or may be accomplished by dielectric heating inside the material itself. To accomplish this, high frequency oscillations are required, and these are produced by the usual vacuum tube oscillator circuit. The internal arrangement of a dielectric heating unit is shown in Fig. 7. Its application to the drying of textiles has already been discussed in the literature, and application to research purposes for the treatment of materials under high temperatures is under investigation. It would appear that this device has definite possibilities as a laboratory instrument for the production under control of various conditions in the sample which it is desired to study.

The development of the electric strain gage for measurement of deformation and also of load has led to the devising of a number of instruments for measurement of physical properties of textile materials. This work has been initially discussed in a paper by Hindman and Krook[8], and involves, in general, the bonding of one or more electric strain gages to a metal cantilever which is designed properly for strength, deflection, and frequency of vibration. One application is indicated in Fig. 8, and takes the form of a resilience tester. Here the cantilever carrying the electric strain gage supports the sample which is pressed upon by a foot under the control of a motor drive which raises and lowers the foot as may be desired. Pressure of the foot will deform the sample, and this deformation can be registered on a chart if the motion of the chart at every instant is proportional to the travel of the presser foot. The load which is produced is registered by the electric strain gage and is sent as a signal to a General Electric Photo-electric Potentiometer Recorder which, by deflection of a pen across the chart, registers the magnitude of the load. Thus, a continuous load-deformation diagram is possible for cyclic operation of the instrument.

M. I. T. Textile Division Photo

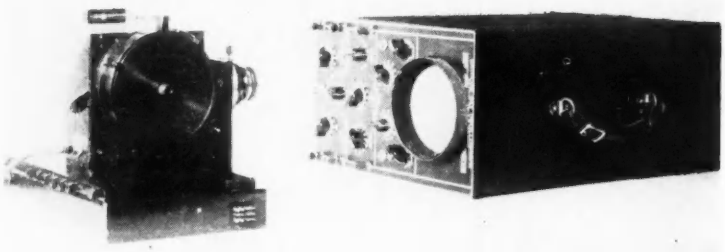
Figure 11
Creep Tester. (Deformation at Constant Load.)



M. I. T. Textile Division Photo

Figure 12
Slater Impact Tester—Showing Electronic Control and Operating Panels. (Compare with Figure 6 which Shows the 500 Pound Weight in Motion.)

A further utilization of this principle for measurement of compressional resilience is in a device which operates at constant deformation and registers on a galvanometer scale the decay of the load as the fibers become "tired" of supporting the pressure. A material which maintains the pressure well over a period of time is therefore more resilient than one in which the load falls off rapidly when a constant



M. I. T. Textile Division Photo

Figure 13
High Speed Camera and Oscillograph Set to Record Load-deformation Surves for Slater Impact Tester.

volume is maintained in the instrument. The device is illustrated in Fig. 9.

In addition, it is possible to measure creep of samples at constant deformation by use of the device shown in Fig. 10. A sample may also be loaded instantly and without jar by means of a motor-controlled loading system, (Fig. 11), and then under action of this continuously applied load, will deform with time. A slide wire unit gives a varying signal as the length of the specimen changes, and this signal is electronically recorded by means of photo-cells and vacuum tubes in either the General Electric Photo-electric Potentiometer Recorder or some equivalent type of device. This obviates the necessity for constant attention by an operator and the difficulty of making visual readings at some intervals of time which may be either inconveniently short or inconveniently long.

At the other extreme of time-load-deformation studies is the impact or shock test. Here the load is applied in a small fraction of a second but with sufficient energy to cause failure of the specimen. The Slater Impact Tester[9] at M.I.T. (Fig. 12) is a dual machine weighing several tons and using either of two weights, one of which weighs twenty-five pounds while the other weighs five hundred pounds. Either weight can be released from a magnet located above the ceiling level of the Slater Laboratory, and as it falls (at a speed of approximately 26 feet per second), it picks up the lower end of the specimen, held in a floating jaw, and carries it to failure at this same speed. An electric strain gage supports the upper end of the sample and registers the force acting, by variation of its resistance to flow of a constant, impressed current. The resultant variable signal is amplified by means of several vacuum tubes, and fed to an oscillograph. The latter also employs vacuum tube amplification to further build up the signal. The deflection of the electron beam in the oscillograph produces a moving spot on the fluorescent screen. A high speed camera photographs this motion on a film moving at right angles to the direction in which the spot is traveling (Fig. 13). The resulting line depicts the load-deformation behavior of the sample. In order to operate the machine efficiently, a control panel is required in which vacuum tubes are employed for amplification, for rectification, and for control purposes. Only electronics could make possible the functioning of apparatus which must operate at such speeds. Momentum, inertia, and friction have been three of the most bothersome things with which the instrument designer has had to contend. Now electronics bids fair to eliminate difficulties such as these and allow much more intelligent study of textile materials. The properties of the material under test can now be studied without interference of machine characteristics. The matter of which textiles are composed is in last analysis made up of energy. To study it by the very energy of which it is composed seems only logical.

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Wear Tester—

(Concluded from Page P192)

There is more interest now than ever before in the end use of merchandise. Probably this interest was first expressed in Army and Navy specifications, but a more fundamental trend may be observed in the progress of science as applied to the productilon of things by industry. Indeed, we are approaching an era of refinement of textile products in the consumers interest. Ultimate wear found in a fabric is soon to become the measured factor of durability of the product it composes.

DISCUSSION

Dr. Mosher: Mr. Masterson, how does your abrasion machine differ from that produced by TBL?

Mr. Masterson: It is the same machine.

Dr. Mosher: And what errors do you encounter?

Mr. Masterson: In the TBL machine?

Dr. Mosher: That is right, you can produce it in what degree of error?

Mr. Masterson: I think we can produce that within 25 revolutions.

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pH Meter—

(Concluded from Page P193)

DISCUSSION

Mr. Winter: I would like to ask if it is possible to build a machine which indicates concentration instead of pH.

Mr. Paully: It would be rather difficult.

Mr. Winter: That is, reading pounds of soda as per—

Mr. Paully: No, that would actually be a titration, wouldn't it? You would want to know the quantity. That would be a complicated instrument, because it would require a unit for titrating and converting your reading into quantity. It would not be possible to have a simple conversion of a pH meter to read total acidity.

Mr. Hausman: What is the highest temperature?

Mr. Paully: The electrode system is the limiting factor in temperature. The ordinary glass electrodes are good up to 50 degrees C. Electrodes are available that are good up to 95 degrees C.

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Vinyon—

(Continued from Page P197)

Some of these dyes fall in Class I and all may be placed in Class II. In general, they may be applied in the same manner as basic colors. In rare cases, good light fastness may make the use of oil soluble colors desirable, but at present the use is very limited.

PIGMENT COLORS

The application of pigment colors with a resin bond shows good promise for work in light shades where considerable light fastness is required. The problems of proper binding is complicated by the low temperature restrictions.

CALCOVIN DYES

Before the war, the Calco Chemical Division, of American Cyanamid, developed a few special dyes for "Vinyon." These dyes were designed to include their own dyeing "assistant" making the problem of preparation of the dye liquor more simple. The characteristics of dyeings made with these dyes were similar to those of the better acetate dyes applied by "assistant" methods.

CONCLUSION

"Vinyon" UST or HST can be dyed with varying efficiency with nearly all dyes. The acetate dyes are at present the most used and are usually applied by the use of "assistants." The choice fo chemicals for use and the simplification of the present methods of preparation of these "assistant" chemicals in the dye liquor is still in need of further work. A solvent method of applying acetate dyes is available which gives indication of use for pad dyeing. A solvent method of applying acid and direct dyes offers the possibility of the use of these dyes to obtain a full range of shades of improved fastness to light, soaping, rubbing, and migration. This method of application may increase in importance if granted specialized equipment and improvements in technique. Again stressing the trend towards solvent dyeings brings up the desirability of "salt free" dyes, since the presence of salt can become a decided disadvantage in standing baths. Continued increase in the knowledge of "assistants" and solvents combined with the help of dye manufacturers in the making of dyes which can act as their own "assistant" will bring the procedures of dyeing "Vinyon" as well as other synthetic filaments nearer the point of efficiency reached in dyeing the natural fibers and rayons.

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[5] Heyman, "Amer. Dyestuff Reptr.," *30*, 575, 578 (1941).
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[7] Petke & Klein, "U. S. Patent" No. 2,257,076

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MEETING, NEW YORK SECTION

THE last meeting of the New Lork Section was held on March 29th at the Downtown Athletic Club, New York City. An informal dinner preceded the meeting.

The chairman, Emmett J. Driscoll, discussed the possibility of holding an outing this year and the Outing Committee will investigate this further.

The following Nominating Committee was appointed, to present a slate of officers at the meeting on May 3rd: Robert O'Hara, chairman, Kenneth Barnard, and Clark Heydon.

Members were requested to submit suggestions for a suitable subject for the Intersectional Contest Paper to the chairman of the technical program committee, Charles W. Dorn, by April 15th.

The technical program consisted of a symposium on "Plastics: The Relation of Compounding and Processing to the Properties of the Final Product." Subjects and speakers were as follows:

1. "Unsupported Films and Sheetings." By C. W. Patton, Bakelite Corp.
2. "Mono-Filaments and Products Made There-from." By M. R. Radcliffe, Firestone Industrial Products Corp.
3. "Coated Fabrics: A Guide to Testing." By R. E. Thomas, Chemical Dept., Fabrikoid Division, E. I. duPont de Nemours & Co., Inc.

The attendance was 235.

Respectfully submitted,
NORMAN A. JOHNSON, *Secretary.*

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INTER-SOCIETY COLOR COUNCIL

15th Annual Meeting, Hotel Pennsylvania, New York, N. Y., May 6-7, 1946.

PROGRAM

May 6

9:00 A.M. Registration.

10:00 A.M. Discussion Session: Art and Color: Chairman: Ralph M. Evans.

Color in Painting and Design—Arthur Pope, Harvard University.

Color Illusions of the Painter—J. Scott Williams, New York City.

2:00 P.M. Discussion Session and Exhibit: Colorimetric Standardization of the Colors of the TCCA Standard Color Cards: Chairman: Wm. D. Appel.

Co-sponsored by the Textile Color Card Association of the United States, Inc., and by the American Association of Textile Chemists and Colorists.

Spectrophotometric Measurements, Harry J. Keegan

Colorimetric Measurements, Genevieve Reimann

Applications, Deane B. Judd.

Prepared Discussion:

Colorimetric Measurement of Fluorescent Textiles, I. H. Godlove

Angular Conditions for Colorimetry of Textiles, E. I. Stearns

Benefit to Industry of Measured Standards, J. F. Warner.

8:00 P.M. Illustrated Lecture: Chairman to be announced.

Joint with the Society of Motion Picture Engineers

Lighting a Subject for Color Photography, Ralph M. Evans.

May 7

9:30 A.M. Technical Session: Symposium on Color: Chairman to be announced.

Arranged for the Society of Motion Picture Engineers

Color for Producer and Consumer, I. H. Godlove

Light Sources and Colored Objects, Ralph M. Evans

2:00 P.M. Business Session: Chairman: Ralph M. Evans

Annual Reports of Officers.

Annual Reports of Committees.

Annual Reports of Member Bodies.

Copies of this program may be obtained from the secretary: Dorothy Nickerson, P. O. Box 155, Benjamin Franklin Station, Washington 4, D. C.

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MEETING, RHODE ISLAND SECTION

THE meeting of the Rhode Island Section was held on March twenty-second at the Providence Engineering Society Hall, Providence, Rhode Island. Approximately 135 persons were present.

Walter Ridley, Sales Manager for the Textile Industry of The Foxboro Company spoke on "Control Instruments and Their Application to Textile Dyeing." He discussed and described the modern methods of automatically controlling time and temperature in dyeing and finishing. He described in detail the newly developed, scientifically controlled instruments being made by The Foxboro Company and which are now in practical use in many reputable finishing companies.

William D. Fales, Head of the Textile and Clothing Division (days) and Supervisor of the Evening Extension School, Rhode Island School of Design, spoke on "Textile Education." His talk mainly concerned textile educational facilities and textile educational systems in this country. He could not in this paper give any particulars concerning the information obtained during his trip to Germany and will not be able to until this information is released by the War Department.

The next meeting of this section will be held on April twenty-sixth. Speakers and their subjects are as follows:

Peter G. Kolupaev, Chief Chemist, Slatersville Finishing Company—"Color

Measurement and Its Textile Applications."

Edwin Blanchard Brown, in Charge of Foundation Design Program at the Rhode Island School of Design and Instructor of Professional Design, Specializing in Printed Textiles. "Color—Of the Heart and of the Mind."

Special Notice

The Rhode Island Section will hold their annual outing at the Pawtucket Golf Club on Friday, June fourteenth. The outing committee consists of the following persons:

Robert P. Wood, Chairman

Edward J. Allard, Charge of Seating Arrangements and Equipment

Robert R. Farwell, Wilfred A. Lord and Allison Fletcher, in Charge of Prizes

Newton Graves, Charge of Tickets

Irving Lakey and Emery Richards, Dinner Committee

James C. Shore, Publicity

A turn-out of about 750 persons is expected. The usual golf tournament will be held. Ralph Hoars, chemist at the Apponaug Company won the members' golf trophy in 1941 and 1942. After he entered the service, the Rhode Island Section donated the trophy to him permanently. He has offered to place the trophy back in competition but this offer was not accepted, and a new golf trophy is being substituted. The golf tournament is open both to members and guests. There will also be the usual putting tournament.

Definite arrangements for food have not been made as yet but it is expected that there will be a choice of a fish or a meat dinner.

Tickets may be obtained from Newton A. Graves, 53 Albert Stone Road, Pawtucket, Rhode Island after May fifteenth. No tickets can be purchased after June eighth. Members will receive further notification concerning the outing.

Respectfully submitted,
JAMES C. SHORE,
Secretary

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MEMBERSHIP APPLICATIONS

Senior

William L. Hicks—Chief Chemist, Excelsior Mills, Union, S. C. Sponsors: E. T. Mobley, S. H. Williams.

George E. Hine—Dyer, Berkshire Knitting Mills, Reading, Pa. Sponsors: J. Corea, H. L. De Turck.

Fred J. Hope—Chemist, H. Kohnstamm & Co., Inc., Brooklyn, N. Y. Sponsors: W. D. Appel, W. C. Bainbridge.

Robert I. Hornstein—Technician, Cohn-Hall-Marx Co., New York, N. Y. Sponsors: E. A. Schlesinger, K. J. Winter.

George T. Howe—Chemist, Plastic Film Corp., Plainfield, Conn.

Hans K. Hygen — Managing Director, Kunstsilkefabrikken, A/S, Notodden, Norway. Sponsors: C. A. Sylvester, C. Conradi.

Samuel E. Jarrett—Assist. Dyer, Renfrew Bleachery, Brandon Corp., Travellers Rest, S. C. Sponsors: W. L. Barker, D. H. Kennemur, Jr.

Cledith E. Jeremiah — Supt. of Dyeing, Princeton Knitting Mills, Watertown, Conn. Sponsors: E. Young, H. E. Stanley, Jr.

Carl Johnson—Plant Supt., Royal Screen Print Co., Paterson, N. J. Sponsors: W. N. Deuble, G. W. Searell.

Talbot A. Lancaster — Plant Chemist, Plastic Film Corp., Plainfield, Conn.

William L. Lawson—Vice Pres., Whitehouse Products Inc., Brooklyn, N. Y. Sponsors: E. I. Stearns, L. J. Fidell.

Martin Leatherman — Research Chemist, Pennsylvania Salt Mfg. Co., Philadelphia, Pa.

John A. Liddle—Dyer, Rainwear Toscony Fabrics, Inc., Passaic, N. J. Sponsors: J. P. Bauer, T. Hirsch.

John E. Livak—Research Chemist, Deering, Milliken Co., New York, N. Y. Sponsors: G. Rogers, E. T. Mobley.

Edward M. Lynch, Jr.—Chemist, The Derby Co., Lawrence, Mass. Sponsors: R. E. Derby, E. B. Bell.

Douglas Martland — Chemist, Cranston Print Works Co., Cranston, R. I. Sponsors: R. C. Smith, H. J. Cranston.

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—♦ ♦—

MEETING, MID-WEST SECTION

AT the meeting of the Mid-West Section to be held on May 4th at the Schroeder Hotel, Milwaukee, Wisconsin, Calco's new sound and color film entitled "Portrait of an Industry" will be shown.

●

CALENDAR OF COMING EVENTS

NORTHERN NEW ENGLAND SECTION
Meeting: May 17.
Outing: June 7

RHODE ISLAND SECTION:
Meeting: April 26.
(Providence Engineering Society Hall, 195 Angell Street, Providence, R. I.)
Outing: June 14.
(Pawtucket Golf Club, Pawtucket, R. I.)

PHILADELPHIA SECTION:
Meeting: May 24.

NEW YORK SECTION:
Meeting: May 3.
(Downtown Athletic Club, 19 West St., New York City.)

MID-WEST SECTION:
Meeting: May 4.
(Schroeder Hotel, Milwaukee, Wis.)
Outing: June 22
(Lake Lawn, Delavan, Wis.)

NATIONAL CONVENTION:
Silver Jubilee Convention: December 12, 13 and 14.
(Hotel Statler, Boston, Mass.)

●

The Resistance of
TREATED COTTON FABRICS
to Attack by Termites and Micro-Organisms

R. A. ST. GEORGE and MARGARET S. FURRY

Bureau of Entomology and Plant Quarantine — *Bureau of Human Nutrition and Home Economics*

Agricultural Research Administration
U. S. Department of Agriculture

COTTON fabrics used out of doors, for military or for farm and household purposes, are subjected to the deteriorating action of both termites and micro-organisms. Although losses from termite attack are not so general as losses from micro-organisms, they can be very great and cause enormous waste of materials. Chemical finishing treatments that protect fabrics from both these destructive agencies would be particularly advantageous[1, 4, 5]. This paper reports the effectiveness, as a protection against termite and micro-organism attack, of 16 chemical treatments that have been used to make cotton fabrics mildew-resistant[2, 3].

MATERIALS AND METHOD OF TREATMENT

The fabric, a 7-ounce osnaburg, was cut into strips, 6 inches in the direction of the warp and 2 inches in the filling, and the strips were randomized for treatments and controls. Ten replicates of each treatment were used. Before the samples were treated, they were conditioned for 24 hours and weighed in a controlled temperature-humidity room maintained at 70°F. and 65 per cent relative humidity.

The details of the treatments are given in table 1. Each strip was processed separately in 50 ml. of the finishing bath, quickly removed, pressed between two sheets of blotting paper, dried at room temperature for 48 hours, rinsed twice for 5 minutes in two changes of water at 25°C., pressed as before, dried, and again conditioned and weighed. When the treatment was applied in two baths, the strip on being squeezed from the first bath was immediately immersed in the second. Finally, all strips for laboratory and field tests were leached in running water for 24 hours.

RESISTANCE TO TERMITES

In order to determine the resistance of treated fabric to attack by subterranean termites, test samples were kept for a given period of time on moist ground out of doors in a wooded area where a natural infestation of termites was known to exist. In preparation for the test, sticks and other debris on the surface of the ground were removed, and a paper towel, folded to approximately a 5-inch square, was placed on each cleared space and covered with an 18-inch length of 2-by-4 wood. The soil was carefully packed around the edges of the wood, in order to conserve moisture. As soon as termite activity was noted beneath the paper, a fabric sample was inserted between the paper and the wood. Again the soil was carefully packed, both to conserve moisture and to protect the termites from attack by ants and other predatory insects. The replicate strips of the various treated fabrics were randomized over the area.

The paper towel and wood attracted the termites by providing them with abundant food. Moreover, the damage to the towel was an indication of termite activity during the period of the test. In no instance did the towel and wood seem to deter the termites from attacking either the partially resistant chemically treated fabrics or the untreated controls.

Termites work best when left undisturbed over long periods of time. This gives them an opportunity to construct numerous tunnels over the material. Therefore, although the samples were observed at frequent intervals, only two comprehensive examinations were made after approximately 78 and 130 days. Except at the final examination, each test strip was returned to its original position and the soil was carefully replaced around the edges of the wood.

The fabric strip was considered as having been subjected to adequate test when the paper toweling beneath it was at least partially consumed by the termites. When the paper was completely destroyed, another piece of toweling was inserted in its place. The test was regarded as being inadequate when the sample and the paper toweling beneath it remained undamaged. In such cases the sample was not included in the final evaluation of the chemical finish.

The resistance of each chemical treatment to termite attack was measured by the extent to which it protected the fabric from damage. Five degrees of infestation or damage to the fabric were recognized, as follows: Heavy, 25 per cent or more of the sample destroyed; medium, less than 25 per cent of the sample destroyed, but more than three penetration holes; light, from one to three penetration holes; trace, no penetration holes, but light surface feeding; and none, sample undamaged.

Termite activity at the surface of the ground is dependent largely on weather conditions. For this study the ground was cleared and the paper towels were put in place the latter part of April 1943. In 10 days approximately 10 per cent of the towels were infested with termites; in 30 days, or by about May 24, 60 per cent were infested, at which time the treated fabrics and the untreated controls were inserted beneath the wooden blocks. During the month of May rainfall was slightly above normal. However, this period was followed by a 3-month drought, amounting to a deficit of 6.7 inches of rain, which had a marked effect on the moisture at the surface of the ground. During the dry weather there were three periods of 8 to 16 days each when the temperature was considerably higher than the average maximum for those months.

The first attack on fabric was observed about the middle of June, and 3 weeks later approximately 30 per cent of the untreated controls and 9 per cent of the treated samples were infested. By that time, however, the effects of the dry weather were apparent, and most of the termites had left the surface of the ground, presumably to hunt for moisture. Therefore, when the samples were examined on August 10, 78 days after establishment, termites were active under the towels in only about one-fourth of the total number of pieces established.

In September there was an abundance of rain in excess of normal, and the termites came to the surface again to resume their activities. The final examination was made on October 1, at which time approximately 27 per cent of the treated and all the untreated strips had been attacked.

Of the 160 treated strips, 120 were considered as having been under adequate test. It is believed that this number

TABLE 1. FINISHING TREATMENTS APPLIED TO FABRIC

Treatment No.[1]	Fabric Treatment — Bath 1: Chemical	Concentration	Temperature at Which Fabric Was Immersed	Time	Bath 2: Chemical	Concentration	Temperature at Which Fabric Was Immersed	Time	Gain in Weight of Fabric Due to Treatment	Change in Breaking Strength of Fabric Due to Treatment[2]
		Grams Per 100 ml. of Water	°C.	Minutes		Grams Per 100 ml. of Water	°C.	Minutes	Per Cent	Per Cent
10	Cuprammonium hydroxide[3]	10.0	25–30	10	..	..	..	..	0	— 7
11	Copper oleate[4]	17.0	25–30	5	..	..	..	..	13.9	+15
12	Copper naphthenate[4]	12.7	25–30	5	..	..	..	..	11.0	+ 4
	Copper oleate[4]	4.3								
14	Mercuric chloride	1.0	100	30	8-Hydroxyquinoline	2.0	90–95	15	3.1	+18
8	Copper naphthenate[4]	17.0	25–30	5	..	..	..	..	7.5	+22
9	Cuprammonium fluoride[5]	10.0	25–30	10	..	..	..	..	0	+18
4	Osage orange (liquid extract)[6]	10.0	100	16–18 hr.	Potassium dichromate	.3	100	30	9.1	+12
	Copper sulfate	1.0								
17	Copper sulfate	1.0	100	30	8-Hydroxyquinoline	2.0	90–95	15	2.2	+10
2	Quercitron (liquid extract)[7]	10.0	100	16–18 hr.	Potassium dichromate	.3	100	30	3.0	— 1
	Copper sulfate	1.0								
3	Quercitron (liquid extract)[7]	5.0	100	16–18 hr.	Potassium dichromate	.3	100	30	2.8	— 3
	Copper sulfate	1.0								
5	Osage orange (liquid extract)[6]	5.0	100	16–18 hr.	Potassium dichromate	.3	100	30	7.7	+15
	Copper sulfate	1.0								
6	Soap	1.0	100	10	Cadmium chloride	1.0	100	30	.3	0
15	Aluminum acetate	1.0	100	30	8-Hydroxyquinoline	2.0	90–95	15	..	+18
7	Lead acetate[8]	1.0	25–30	10	Potassium dichromate[8]	.3	25–30	10	3.9	+12
13	o-Phenylphenol	.6	25–30	30	..	..	..	..	.2	+13
	Sulfonated castor oil	1.0	100							
16	Magnesium sulfate	1.0	100	30	8-Hydroxyquinoline	2.0	90–95	15	4.0	+15

[1] Treatments arranged in order of resistance to termite attack as given in Table 2.
[2] A plus sign preceding the value indicates an increase and a minus indicates a decrease. All values of 10 per cent and greater indicate a significant change.
[3] Contained 1.5 per cent of copper and 20 per cent of ammonia, prepared as directed in "A study of the raw cotton and the yarn and sheeting manufactured from three grades of American upland cotton," U. S. Dept. Agr. Tech. Bul. 406, March, 1934.
[4] Commercial product contained approximately 6 per cent of copper and was dispersed in Stoddard solvent; from 0.8 to 1.0 per cent of copper on the treated fabric.
[5] Commercial product contained approximately 10 per cent of copper; from 0.8 to 1.0 per cent of copper on the treated fabric.
[6] Contained 27 per cent of tannin.
[7] Contained 22.2 per cent of tannin.
[8] Repeat treatment procedure 3 times.

allowed for sufficient replicates for each treated fabric to make the results conclusive. For instance, 9 treated fabrics had 8 or more replicates each under adequate test, 4 fabrics had 7 replicates, 2 fabrics had 6 replicates, and 1 fabric had 4 replicates. The last fabric, treated with copper oleate, seemed to be highly resistant to termites, since all 4 replicates remained undamaged throughout the test.

RESISTANCE TO MICRO-ORGANISMS

Resistance of the treated fabrics to micro-organisms causing mildew was determined in the laboratory according to the soil-suspension method[3]. The samples tested were similar to those used for determining resistance to attack by termites. They were prepared for the raveled-strip breaking-strength test, inoculated by agitation for 30 minutes in a thin suspension of soil, and then placed in culture bottles and incubated under controlled conditions for 14 days. The growth of the micro-organisms on the incubated strips was noted, and the samples were washed and tested for breaking strength. The effectiveness of the treatment under test was determined by comparing the breaking strength of the inoculated test strip with that of the uninoculated treated controls.

DISCUSSION OF RESULTS

The relative effectiveness against attack, both by termites and by micro-organisms, of 16 finishing treatments applied to cotton osnaburg is given in table 2. For convenience in interpreting the results, the treatments are grouped according to the protection they gave the fabric in resisting attack by termites.

In general, finishing treatments that protect the fabric from attack by termites also made it resistant to micro-organisms in soil. However, some effective mildew-resistant treatments allowed slight attack by termites, and two allowed heavy attack (Figure 1). Five treatments gave excellent protection against attack by both termites and micro-organisms — cuprammonium hydroxide, copper oleate, a mixture of copper naphthenate and copper oleate, mercuric chloride with 8-hydroxyquinoline, and copper naphthenate. Except for light infestation on one of the strips treated with copper naphthenate, these five treatments were equally effective.

Six treatments were slightly less effective against termites than were those listed above — cuprammonium fluoride, copper sulfate with 8-hydroxyquinoline, and two different proportions of each of two natural dye extracts, Osage orange and quercitron, with copper sulfate and potassium dichromate. Although they permitted light attack by termites (Figure 1, test strip 17H), no doubt under many conditions of use they would be entirely satisfactory and give adequate protection to fabrics. When tested by the soil-suspension method, these treatments, with the exception of cuprammonium fluoride,

TABLE 2. RESISTANCE OF CHEMICALLY TREATED FABRIC TO DAMAGE CAUSED BY TERMITES AND MICRO-ORGANISMS. TREATMENTS ARRANGED IN ORDER OF RESISTANCE TO TERMITE ATTACK

Treatment No	Fabric Treatment[1] Chemical	Concentration	Resistance to Termite Attack (Field Test) Period of Test	Samples[2] of Treated Fabric Arranged According to Degree of Infestation by Termites: Heavy	Medium	Light	Trace	None	Resistance to Micro-Organism Attack (Laboratory Test) Breaking Strength of Treated Fabric: Not Inoculated	Inoculated With Soil and Incubated for 14 Days	Change in Breaking Strength Due to Inoculation and Incubation[3]
		Grams Per 100 ml.	Days	Number	Number	Number	Number	Number	Pounds	Pounds	Per Cent
1	Untreated	..	78	1	1	1		7	68	0	—100
			130	6	3	1					
10	Cuprammonium hydroxide	10.0	78					8	63	59	— 6
			130					8			
11	Copper oleate	17.0	78					4	78	74	— 5
			130					4			
12	Copper naphthenate	12.7	78					7	71	77	+ 8
	Copper oleate	4.3	130					7			
14	Mercuric chloride	1.0	78					9	80	74	— 8
	8-Hydroxyquinoline	2.0	130					9			
8	Copper naphthenate	17.0	78					6	83	76	— 8
			130			1		5			
9	Cuprammonium fluoride	10.0	78			1		6	80	32	— 60
			130			1	1	5			
4	Osage orange	10.0	78			1		6	76	78	+ 3
	Copper sulfate	1.0	130			1	1	5			
	Potassium dichromate	.3									
17	Copper sulfate	1.0	78					6	75	74	— 1
	8-Hydroxyquinoline	2.0	130			1	2	3			
2	Quercitron	10.0	78			1		7	67	62	— 7
	Copper sulfate	1.0	130			2		6			
	Potassium dichromate	.3									
3	Quercitron	5.0	78			1		8	66	62	— 6
	Copper sulfate	1.0	130			2		7			
	Potassium dichromate	.3									
5	Osage orange	5.0	78			1		7	78	68	— 13
	Copper sulfate	1.0	130		2			6			
	Potassium dichromate	.3									
6	Cadmium chloride	1.0	78			1		6	68	15	— 78
	Soap	1.0	130	1	1	1		4			
15	Aluminum acetate	1.0	78			1		7	80	75	— 6
	8-Hydroxyquinoline	2.0	130		2	3	1	2			
7	Lead acetate	1.0	78	1		1		6	76	56	— 26
	Potassium dichromate	.3	130	1	1	4	1	1			
13	o-Phenylphenol	.6	78	1	1	2		6	77	17	— 78
	Sulfonated castor oil	1.0	130	3	1	2		4			
16	Magnesium sulfate	1.0	78	1		1		6	78	73	— 6
	8-Hydroxyquinoline	2.0	130	4	2	1		1			

[1] See Table 1 for detailed information on treatments.

[2] The difference between the 10 samples subjected to test and the total number recorded in the 5 columns is due to instances of inadequate test.

[3] The plus sign preceding the value indicates an increase in breaking strength; a minus indicates a decrease. All values of 10 per cent and greater indicate a significant change in strength from the corresponding treated fabric.

gave excellent protection against micro-organisms. However, additional cuprammonium fluoride in the fabric makes this treatment equally as effective as the others.

It should be noted that, of the 11 finishing treatments so far mentioned as giving fabric good to excellent protection against attack by termites, 10 of them contain copper in their formulation; the other contains mercury.

The remaining five treatments — cadmium chloride with soap, aluminum acetate with 8-hydroxyquinoline, lead acetate with potassium dichromate, *o*-phenylphenol and magnesium sulfate with 8-hydroxyquinoline (Figure 1, test strips 6H, 6D, 15I, 13B, and 16K)—were ineffective in preventing termite damage. As shown in table 2, three of these treatments (Nos. 6, 7, and 13) also gave little or no protection against micro-organisms. Cadmium chloride and soap (No. 6) was not effective when tested by the soil-suspension method, although in previous studies[2] it was found to make cotton resistant to *Chaetomium globosum*. No doubt in the present tests most of the *o*-phenylphenol (No. 13) was leached from the fabric, since it was attacked both by termites and micro-organisms. Lead acetate with potassium dichromate (No. 7) gave considerable protection against micro-organisms, since samples treated with this finish lost only 26 per cent of their strength.

Aluminum acetate and magnesium sulfate, when combined with 8-hydroxyquinoline, form excellent mildew-preventing treatments in the fabric, but they do not protect against termite damage. Apparently these addition products are not toxic to termites. On the other hand, finishing treatments formed by combining 8-hydroxyquinoline with mercuric chloride (No. 14) and copper sulfate (No. 17) are effective against both termites and micro-organisms.

It is realized that in this field test destructive agents other than termites were also present. No doubt the samples of treated fabric were also subject to many different micro-organisms at temperatures and humidities that would bring about considerable growth. Although no attempt was made to identify the organisms, in-

Figure 1. Fabric strips subjected to termite attack: 17H, treated with copper sulfate and 8-hydroxyquinoline, light infestation; 10G, treated with cuprammonium hydroxide, undamaged; 11I, treated with copper oleate, undamaged; 12F, treated with copper naphthenate and copper oleate, undamaged; 14F, treated with mercuric chloride and 8-hydroxyquinoline, undamaged; 15I, treated with aluminum acetate and 8-hydroxyquinoline, light infestation; 6H, treated with cadmium chloride and soap, medium infestation; 13B, treated with o-phenylphenol, medium infestation; 16K, treated with magnesium sulfate and 8-hydroxyquinoline, heavy infestation; 6D, treated with cadmium chloride and soap, heavy infestation; CK, untreated fabric, medium to heavy infestation. Remnants of termite tubes are clearly visible on both the damaged and undamaged samples.

terest arose in knowing the extent of their deteriorating effect on test strips that had withstood termite attack. Therefore, breaking-strength determinations were made on the strips that had entirely resisted termite attack, as well as on those that had allowed light damage by termites. All the treatments except cuprammonium fluoride gave good protection. The strips retained from 70 to 97 per cent of their breaking strength, whereas the samples treated with cuprammonium fluoride retained only 50 per cent. Although the extent of damage is considerably greater than that obtained in the previous soil-suspension test, the two sets of results are in agreement. It must be remembered, however, that the conditions of the two tests differ widely.

SUMMARY

The effectiveness against attack, both by termites and by micro-organisms, of 16 finishing treatments applied to cotton fabric has been determined. In general, finishing treatments that protect fabric from attack by termites also made it resistant to micro-organisms. However, some effective mildew-resistant treatments allowed slight attack by termites, and 2 allowed heavy attack.

The following treatments gave excellent protection against attack by both agencies: Cuprammonium hydroxide, copper oleate, a mixture of copper naphthenate and copper oleate, mercuric chloride with 8-hydroxyquinoline, and copper naphthenate. The following treatments permitted light attack by termites and, with the exception of cuprammonium fluoride, gave excellent protection against micro-organisms: Cuprammonium fluoride, copper sulfate with 8-hydroxyquinoline, and two different proportions of each of two natural dye extracts, Osage orange and quercitron, with copper sulfate and potassium dichromate. The remaining five treatments, under the conditions of this test and in the concentrations used, were ineffective in preventing termite damage.

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Your RED CROSS must carry on!

TRADE NOTES • NEW PRODUCTS

• AMERICAN DYEWOOD TRANSFER

Stanley Shultz, salesman for the American Dyewood Company, has been transferred to Chattanooga, Tenn., and will cover Georgia, Tennessee, North Carolina and South Carolina.

• JOURNAL OF COLLOID SCIENCE

Academic Press, Inc., 125 East 23rd New York 10, N. Y., announces a new publication: "Journal of Colloid Science." It is devoted to scientific, technological and biological aspects of colloid science, ranging from the physics and chemistry of colloids and surface phenomena to technology of emulsions, ore flotation, plastics, textiles, the dyeing industry, detergents, photography, etc. It will be published bi-monthly and the first issue appeared in January.

• JOINS CONCORDIA-GALLIA

Donald Pearson, B.T.S., has joined the Concordia-Gallia Corporation as Quality-Control Engineer, and will work in cordination with Charles Ochsner, who heads Concordia-Gallia's converting department. Mr. Pearson studied chemical and textile engineering at both the New Bedford Textile Institute, and the North Carolina State College, graduating from the former. He is a member of the American Association of Textile Chemists and Colorists, the American Institute of Chemical Engineering, and the American Chemical Society.

• OFFICES, PHILADELPHIA TEXTILE FOUNDATION

Colonel Millard D. Brown, President of the Board of Trustees of The Philadelphia Textile Institute Foundation, has announced that executive offices of the Foundation were opened on April 8, in Rooms 1200 and 1201 in the Land Title Building, Broad and Chestnut Streets, Philadelphia.

The enlarged activities of the Foundation will be carried on at this new address under the direction of Emil R. Pohlers, Executive Director of the Foundation.

• PHI PSI BANQUET

Alpha Chapter of the Phi Psi Fraternity celebrated its 43rd Birthday at the St. James Hotel, Philadelphia, the evening of Thursday, March 21, at its annual Founders' Day Banquet. A very representative gathering attended, including men from the New York and Boston areas.

Harold C. Wood, President, and Harold H. Hart, Executive Secretary of the Phi Psi Grand Council spoke briefly on Phi Psi and its development since its founding in 1903. The gathering was addressed by Theodore B. Hayward, Manager, Philadelphia Wool Department, Swift and Company.

Representing the Trustees of the Philadelphia Textile Institute Foundation, Emil R. Pohlers, Executive Director, expressed the appreciation of the Foundation to Phi Psi Fraternity for the outstanding efforts and leadership its members have contributed toward their campaign activities.

Prior to the banquet, Russell C. Osborne, of Rider-Osborne-Devine, Inc., Philadelphia, and J. R. Mason of Millville Mfg. Co., Millville, N. J., were initiated and welcomed into Phi Psi Fraternity as honorary members.

• KENTEX PRINT WORKS

The Kentex Print Works of Providence, R. I., has recently been incorporated by Kenneth J. Broden for the purpose of printing decorative patterns on plastic films, plastic coated fabrics and woven fabrics of synthetic vinyl copolymer constructions.

For the past 18 years Mr. Broden has been affiliated with various textile printing and finishing plants, including the Cranston Print Works, Cranston, R. I., The Aspinook Company, Jewett City, Conn. and Fruit of the Loom, Pontiac, R. I. After being associated with the Aridye Corporation for the past 7 years he recently resigned his position of New England Manager in order to carry on this new business.

• CLUETT, PEABODY LABORATORY

Plans are virtually complete for a modern research laboratory to be erected in Troy at a total cost, including equipment, of $600,000, it was announced recently.

At the same time, he disclosed that the company is planning further modernization of its existing facilities in Troy and is confident that the expected developments of its research, which will be carried out on a greater scale in the new laboratory, will result in the need for further plant additions and will enable the company to employ more persons from this area.

The building will house a complete research and development laboratory, under the direction of E. C. Pfeffer, Jr., company research manager. Mr. Pfeffer came to Cluett, Peabody & Co., Inc. to head up its research division in 1942. Prior to that, he had been connected with the research department of the Continental Can Company. He is a graduate of Massachusetts Institute of Technology.

According to Mr. Palmer, it is anticipated that this laboratory will double the company's present complement of scientific research people who have been specifically trained in the fields of chemistry, engineering, and physics, as applied to textiles and textile processes.

• CLOTHING FOR RUSSIAN RELIEF

More than 16,000,000 pounds of clothing, blankets and textiles valued at $18,271,319.45 were contributed by the American people and shipped to the Soviet Union in 1945, it was disclosed in a report of the American Society for Russian Relief this month.

This brought to a total value of $53,740,897.65 and a total long tonnage of 24,796, all the clothing and textile supplies sent by the relief society since its inception in October, 1941. Many of the garments shipped overseas were made by Russian War Relief knitting and sewing groups which were formed in cities and towns all over the United States.

The organization set up to handle the immense flow of relief goods is amazing and impressive in itself. Into a huge warehouse at 308 Dyckman Street, New York, pour the contributions of every town and hamlet in the nation which has established a committee to donate old garments and sew new ones. There are more than 1,000 such committees. When materials first come in, they are sent to the storage room to be distributed to the various warehouse departments where they are then sorted and packed for shipment. A large staff of sorters examine each item, separating men's, women's and children's clothing, and rejecting any item which is beyond use or reclamation.

More than 500 warehouse employees are kept engaged during the peak of the clothing drive sponsored by the American Society for Russian Relief.

Large baling machines are used to compress contributions of clothing for shipment.

After sorting the clothing, the examiners send it to a large sealed room for fumigation. Then the garments are folded and taken to a large baling machine from which the completed bales are conducted down a chute to the basement for stenciling as to their contents and destination. Finally, a tiering machine lifts the bales, cases or boxes that come down the chute and piles them in stacks to await shipment on the next vessel to the USSR.

Directors of the Russian Relief organization emphasize that the need for continued shipments of old, but still wearable garments remains extremely urgent.

● POLL ON RAYON

In a poll of the members of the American Association of Textile Technologists as to whether American or British definitions of the term "rayon" were desirable, the definition of the American Society for Testing Materials which limits the word to synthetic textiles of a cellulose base was favored by a large majority of those voting.

Votes favoring the A.S.T.M. definition represented 87 per cent, while 8 per cent voted for the definition of the Textile Institute of Manchester, England, which would describe all fibers not of natural occurrence as "rayon."

Of those voting, five per cent took exception to both British and American definitions.

The American Society of Testing Materials definition is as follows: "Rayon, n. —A generic term for filaments made from various solutions of modified cellulose by pressing or drawing the cellulose solution through an orifice and solidifying it in the form of a filament."

The British definition as proposed by the Textile Institute, Manchester, is "Rayon, adj. or n.—A generic term applied to all fibers for textile use which are not of natural occurrence."

● MONSANTO FUNGICIDE

Monsanto Chemical Company has announced that it has re-formulated a 66-year-old German chemical to produce a textile preservative.

When properly formulated and applied at textile mills to fabrics, the chemical is claimed to afford durable protection against airborne superficial and rotter-type fungi as well as against soil inhabiting organisms.

The parent compound is technically known as Copper 8-Quinolinolate, sometimes referred to as the copper salt of 8-Hydroxyquinoline. It will be marketed under the trade name Milmer. Monsanto emphasized that it is a preservative for mill application only.

Water sprays, weather exposure, sunlight and laundering appear to have little or no effect on its permanence as a textile preservative, Monsanto reported, adding that it is free from objectionable odor and compatible with water repellent and fire retardant finishes for textiles.

The product has been found relatively free from skin irritation or toxicity to humans.

Textiles treated with the preservative are colored a light greenish-yellow shade which is light stable and a usable pigment for items such as awnings, canopies and upholstery materials. Where darker shades are desired the color of the preservative can be readily masked.

The parent compound, 8-Quinolinolate, was discovered by German chemists about 1880. So far as is known, no commercial use was found for the copper salt until Monsanto's investigation disclosed its potentialities as a fungicide.

● QUAKER DETERGENT

Dianol G is a newly developed and versatile liquid detergent and wetting agent recently added to the line of Dianol synthetic detergents and wetting agents by Quaker Chemical Products Corporation, Conshohocken, Pa.

When used with alkali builders such as tetrasodium pyrophosphate, Dianol G is claimed to be one of the most efficient synthetic detergents available, on an applied cost basis, for use on all fabrics. It is said to be rated as outstanding for use on wool fabrics, which it scours very well without builders at a pH of about 9.0. It also rinses from all fabrics with extreme ease and no residual odor.

Dianol G is said to dissolve instantaneously in the coldest water and to be stable in hard water and in acidic or alkaline solutions of conventionally used concentrations. There is no excessive foaming when Dianol G is used in processes involving heavy circulation or agitation.

Verd V. Mitchell, Jr. who has joined the Textile Finishes and Chemicals Division of Sylvania Industrial Corporation as a member of the sales staff handling "Ceglin" cellulose ether finishes. During the war Mr. Mitchell was a Major in the Air Corps, having entered it upon graduation from Alabama Polytechnic Institute. He is a native of Tallahassee, Alabama.

The product is said to have no objectionable characteristics either to personnel or to the processes in which it may be used. These are scouring, soaping off, boiling-off, bleaching or any operation requiring a material that is highly efficient both as a detergent and wetting agent. Dianol G is also useful as an auxiliary with soap or soap base detergents to improve detergency and wetting under conditions chemically unfavorable to soap alone.

● POLL ON TRADE AND TARIFFS

While 75 per cent of the American people favor the U. S. expanding its activities in international affairs and trade, 62 per cent are unwilling to go as far as to allow cheap foreign imports to jeopardize the domestic economy, an American Tariff League analysis of recent public opinion surveys reveals.

In a study, just published, entitled "Public Opinion in the U. S. on Foreign Trade," the author, Dr. John Lee Coulter, consulting economist of the League, summarizes recent polls conducted by three nationally-prominent survey organizations as follows:

"In spite of America's interest in world affairs and desire to expand her foreign trade, she definitely is not willing to sacrifice her markets to cheaply-produced goods which endanger domestic employment, the American wage scale and the domestic price level, and thereby threaten her own high standards of living."

On the question whether the U. S. should take an active part in world affairs, one poll revealed that 71 per cent of those polled favored participation, while 75 per cent were shown favorable in an-

other survey conducted by a different group.

In surveys on the importance of U. S. trade with foreign countries, 56 per cent of the persons interviewed favored increased trade in one poll. In another poll, 45.7 per cent declared that the U. S. "needs" foreign trade for real prosperity, while an additional 23.8 per cent replied that foreign trade "helps."

However, in a poll asking the following question: "In order to try out a union of nations as a possible way of preventing wars, would you be willing or not willing to allow competitive imports, even if prices were lower?," 62 per cent of those questioned said they were unwilling to allow competitive imports. Only 28 per cent were willing; 10 per cent had no opinion.

In a poll conducted just after the Japanese surrender, 79 per cent of the replies favored making Japan pay in some way or other for the cost of the war. When asked specifically, "If the only way Japan could pay us for our cost of the war would be in goods, would you be willing for our country to accept any goods which could be sold cheaper than similar goods we make in this country?," 68 per cent declared they were not willing to accept such goods.

The League study also revealed that only 32 per cent of the persons polled approved of buying European shoes and trying to shift American workers, thereby displaced, to other industries. Similarly only 32 per cent approved of buying cheap foreign farm products and inducing American farmers to raise other non-competitive products.

● RUMFORD CHEMICAL EXPANSION

Expansion of the administrative staff for the Chemical Division of Rumford Chemical Works, Rumford, R. I., manufacturers and distributors of industrial chemicals and grocery products, has been announced by Albert E. Marshall, President.

J. Whitney MacDonald, attorney and personnel director since 1943, has been appointed an Assistant to the President, filling the vacancy caused by the recent resignation of Daniel B. Curll, Jr., who served as assistant to Mr. Marshall and general manager of the Chemical division.

Mr. MacDonald, a graduate of Dalhousie University, Halifax, and Harvard Law School, will serve as administrative coordinator in the Chemical division and continue as company attorney.

Arthur H. Razee, a member of the Technical Service Department since 1940, has been promoted to Manager of Chemical Service and Sales. Mr. Razee is the author of several technical articles in trade journals.

Dr. Charles H. Lindsley, who has joined the staff of the Institute of Textile Technology as a physical chemist, after completing his research for OSRD and Chemical Warfare Service at the University of Virginia. Dr. Lindsley received his B.S. M.A. and Ph.D. from Princeton. He has had experience at the Cancer Research Laboratory in Philadelphia, International Nickel Co., and taught chemistry at Black Mountain College, Black Mountain, N. C.

Irving G. Loxley, a member of the Chemical Sales Department since 1941, has been promoted to the position of Assistant Manager of Chemical Sales.

Frank Cutter, associated with the Technical Service Department for the past three years, has been appointed Sales Statistician.

Joseph C. Harvey, Jr., recently discharged from duty as a Lieutenant in the Naval Supply Corps, has been appointed to the Sales Department.

● WAR PRODUCTION OF duPONT

The full scope of the war production role of E. I. duPont de Nemours and Company was revealed recently for the the first time in a special report to stockholders from W. S. Carpenter, Jr., president.

During each of the last three war years, the Company increased its production of chemical materials from its own plants to more than double 1939 levels, the report stated. Included were nylon, plastics, rayon yarn, dyestuffs, industrial chemicals of many types, finishes, insecticides, fertilizers, pigments, photographic film, and a variety of other chemical products.

In addition, Du Pont built for the Government 54 plants of various sizes at 32 different locations. Total cost of these facilities engineered, designed, and constructed for the Government by Du Pont's Engineering Department was $1,034,000,000.

Du Pont-operated, Government-owned plants produced military explosives, ammonia, methanol, neoprene synthetic rubber, and various chemical specialty materials with a total value of $895,000,000.

The Company was called upon, in addition, to undertake a large number of highly specialized assignments, including a part in the atomic energy operation, the organization and execution of an explosives program treble that of World War I, and assistance to Remington Arms Company, a subsidiary, in developing the greatest small arms ammunition output in history.

Between December, 1940, and August, 1945, Du Pont produced approximately 4,500,000,000 pounds of military explosives—three times its 1915-1918 output and 20 per cent above the entire volume used by all Allies during Warld War I. Military explosives, however, accounted for less than 25 per cent of the Company's total production in World War II, compared to approximately 85 per cent in World War I.

Materials produced for military and home-front consumption "ranged from chemicals used in production of heavy armaments to such homely necessities as household cement," Mr. Carpenter said. Major items included:

537,700,000 pounds of rayon yarn and staple fiber;

80,000,000 pounds of nylon yarn and flake;

301,932,000 pounds of neoprene synthetic rubber;

7,700,000,000 pounds of sulfuric acid —the Company's largest single bulk product;

26,153,000 pounds of "Lucite" acrylic plastic sheeting for transparent air craft enclosures;

40,000,000 gallons of paints and other finishes for military needs.

Measured in dollar volume, more than 79 per cent of Du Pont's entire output during the war was produced with its own facilities and its own capital, Mr. Carpenter reported.

The largest single Du Pont undertaking of the war, he stated, was the Company's part in the atomic energy project, in which Du Pont designed and constructed a small-scale pilot plant of the Clinton Engineer Works in Tennessee, and designed, built, and operated the $350,000,000 Hanford Engineer Works near Pasco, Wash., for the manufacture of plutonium.

"The Company's entire compensation for its services in connection with each of the Clinton and Hanford projects was a fee of $1.00 and, at the Company's own request, it was stipulated that no patent rights growing out of this work should accrue to Du Pont," Mr. Carpenter said.

Du Pont engineered, designed, and constructed eight Government-owned explosives plants, the cost of which approximated $500,000,000, the report stated.

In no instance was operation delayed because of failure to meet construction schedules; nearly all units were ready for initial production months ahead of contract requirements.

Commending "the sustained cooperation and loyalty" of the employes, which "contributed much to the handling of war commitments," Du Pont's president noted that no major labor difficulties occurred and that the loss in man-hours due to work stoppage was less than 1/50 of 1 per cent.

● **PERSONNEL CHANGES at C. & C. C. C.**

H. D. Kinsey has been appointed Works Manager for Carbide and Carbon Chemicals Corporation, Unit of Union Carbide and Carbon Corporation, New York. Mr. Kinsey was formerly General Superintendent of the atomic energy plant operated for the Government by Carbide and Carbon Chemicals Corporation at Oak Ridge, Tennessee. The post of Assistant Works Manager has been taken over by R. K. Turner, who had served since 1940 as Superintendent of the Corporation's plant at South Charleston, West Virginia. Mr. Turner joined the organization in 1924 at Clendenin, West Virginia, and moved to South Charleston in 1925. T. R. Ragland, who joined the staff at this plant in 1928 and has been Assistant Superintendent since 1940, succeeds Mr. Turner as Superintendent. At the South Charleston plant G. H. Sears is now Assistant Superintendent in charge of industrial relations, and E. P. Shetter is Assistant Superintendent in charge of the gas separation and related departments.

● **DEXTER APPOINTMENT**

The Dexter Chemical Corporation announces the appointment of Morris Mytelka as chemist in charge of production for its textile chemical division. After gaining his degree in chemistry at Rutgers, Mr. Mytelka was associated with the laboratories of the Bakelite Corporation and the Battery Manufacturing Corporation and for the past ten years has been analytical and research chemist for the Hart Products Corporation.

Under Mr. Mytelka's supervision, the laboratories of the organization at the plant on Edgewater Road in New York City are being enlarged and new equipment added and the staff is to be increased.

● **GENERAL ANILINE MEETING**

Recent scientific developments in the chemistry and physics of dyestuffs featured a three day meeting of 150 key chemists, physicists and chemical engineers of General Aniline and Film Corporation at Skytop Lodge, Skytop, Pa.

Dr. William T. Ham, Jr., who has been appointed to the research staff of the Institute of Textile Technology. He received his B.S., M.S. and Ph.D. in physics from the University of Virginia. He has had experience in teaching and research in physics at University of Virginia and Columbia University. He was also employed at Kendall Mills, W. T. Ham, Inc., and Rouss Physical Laboratory at University of Virginia for OSRD. He served overseas as an officer in radar and retired to inactive duty in January. He is a Fellow of the American Physical Society and a member of Sigma Xi.

The technical men held a series of conferences to review recent research developments and interchanged a variety of technical and scientific information.

New developments in the various research fields in which the company is engaged, ranging from dyestuffs, textile auxiliaries, color films and X-ray films to a variety of fundamental researches in chemistry and physics, were discussed in a series of scientific and technical papers and in open meetings.

This first post-war meeting of the company's research scientists and its other technological workers brought together a group of scientific workers from General Aniline's plants at Grasselli, N. J., Rennselaer, N. Y., Binghamton, N. Y., Johnson City, N. Y., and from the Central Research Laboratory at Easton, Pa.

● **OFFICERS, STEIN, HALL**

Stein, Hall & Co., Inc., New York, has announced the election of Oliver H. Clapp and Robert M. Stein as directors. Mr. Clapp is vice-president in charge of the Sales Division. Mr. Stein, also a vice-president, is associated with the Foreign Division.

Other members of the Board are: Arthur L. Strasser, chairman; Edwin Stein, president; Morris S. Rosenthal, executive vice-president; Robert Rau, treasurer and secretary; Cecil H. Coryat, vice-president in charge of the Foreign Division.

Miss Hannah O'Neill has been elected assistant secretary.

Andre L. Picard of the Foreign Division has been elected a vice-president, and C. J. Dunachie, acting manager of the New York Branch Office, has been named an assistant vice-president. Other officers are: vice-presidents, W. B. Gosman, D. M. Hawley, Alexander Frieden; assistant vice-presidents, Harold M. Johnston, L. F. Turnbull.

Robert Strasser has been appointed Assistant Sales Manager. Mr. Johnston is now manager of the Starch Products Dept., succeeding H. R. Barnett, resigned. Ralph W. Bettleheim is assistant manager of that department and John C. Daly, Jr. is assistant manager of the Burlap Dept.

● **duPONT APPOINTMENTS**

Appointment of Robert L. Richards as assistant manager of the Du Pont Rayon Department and Robert A. Ramsdell as manager of the Nylon Division, succeeding Mr. Richards, have been announced.

Charles M. Switzer, Nylon Division director of production, has been appointed assistant manager of the division to succeed Mr. Ramsdell.

Mr. Richards succeeds James S. Denham. The post of Nylon Division manager has been filled by Mr. Richards since last October when he was transferred from his previous position as assistant manager of the Cellophane Division, another branch of the Rayon Department.

● **BULLETIN ON PYROMETERS**

Cambridge Instrument Co., Inc., 3020 Grand Central Terminal, New York 17, N. Y., announces publication of Bulletin 194-SA entitled "Cambridge Surface Pyrometers." Copies are available upon request.

OBITUARY

ROBERT W. CORNELISON

ROBERT W. CORNELISON, owner and general manager of the Peerless Color Company in Plainfield, N. J., died at his home in Somerville, N. J., on March 31st. He was 76 years old.

Dr. Cornelison was a graduate of the University of Illinois and received his Doctor of Science degree from Harvard University. For fifteen years he was a research and consulting chemist and served for two years in the Bureau of Chemistry, United States Department of Agriculture. He was the first general manager of the Calco Chemical Company and he organized the Peerless Color Company in 1916.

Dr. Cornelison was a member of several scientific societies. He is survived by his widow, three daughters, a brother, and four grandchildren.

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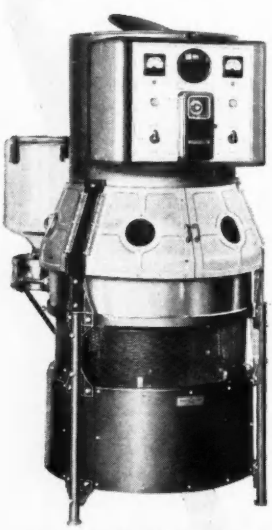

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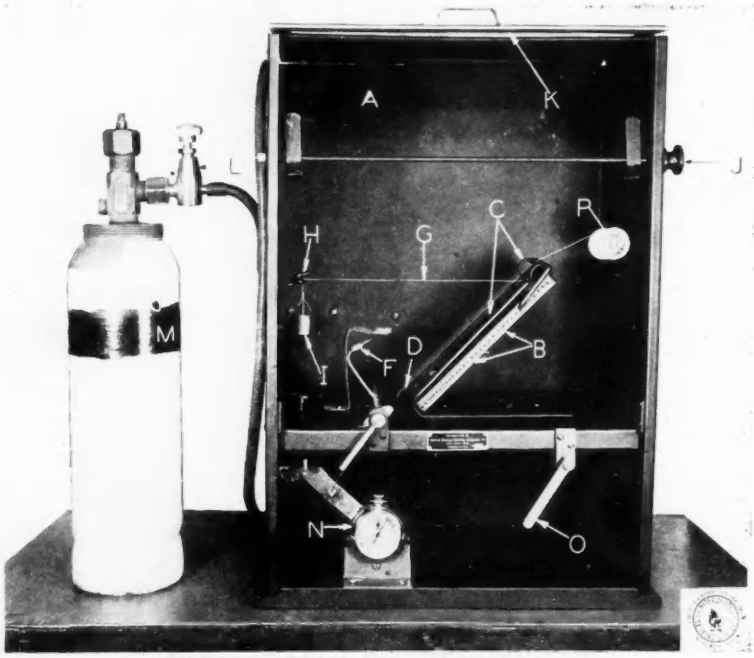

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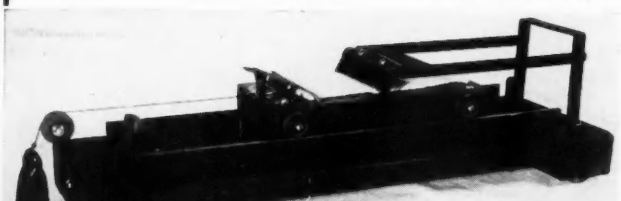

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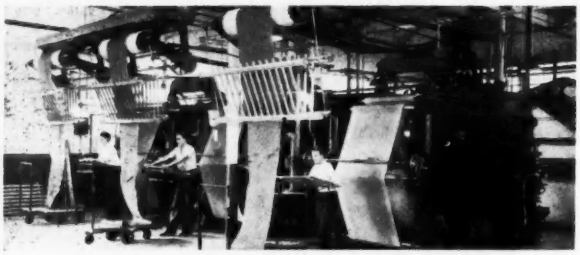

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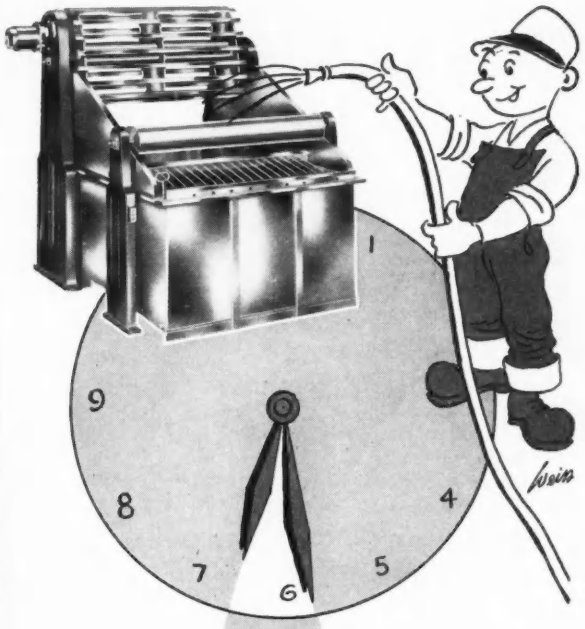

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• CLASSIFIED ADVERTISEMENTS •

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $6.25 per column inch or less per insertion.

CONFIDENTIAL EMPLOYMENT SERVICE — We invite correspondence (confidential) with Dyers, Chemists, Colorists, Superintendents, Master Mechanics, Office Managers, and others seeking positions and with employers seeking high-grade men to fill vacancies or to make replacements. Charles P. Raymond Service, Inc., 294 Washington St., Boston, Mass. Over 45 years in business.

WANTED: A textile specialty manufacturer who desires representation in the middle west. Write Box 839.

WANTED: Technical sales assistant with practical mill experience for the state of Pennsylvania. Must understand throwing and sizing processes, all types synthetic knitting and weaving yarns, including Nylon. Permanent position, excellent opportunity. Replies held in confidence. Give complete information, training, qualifications, age, references. Write Box 846.

WANTED: Recent textile school graduate with the ability to maintain a laboratory control program in woolen textile mill near Troy, N. Y. Application should include detailed statement of education, type of experience, age and expected salary. Write Box 849.

POSITION WANTED: Chemist Dyestuff Salesman interested to represent dyestuff manufacturer in foreign markets, 20 years experience organizing and selling. Write Box 851.

WANTED: DYE CHEMIST, preferably with experience, for research and development. Medium sized plant, growing organization, excellent chance for future. Send record of training and experience with snapshot. Our employees have been notified. Box 853.

POSITION WANTED: Textile chemist and colorist. Graduate of Philadelphia Textile Institute and possessor of degree in chemical engineering. Ten years experience in the rayon dyeing and printing industry as chemist and colorist. Box 855.

WANTED: Young Chemist, preferably textile experience, for application laboratory of Fungicide Manufacturer. Box 852.

POSITION WANTED: Returning Vet desires chemist position in Metropolitan area with responsible dyehouse or chemical firm. In return will furnish new ideas in dyeing synthetic fabrics. Write Box 854.

A Message About Textile Advertising

What Is Textile Wet Processing?

Textile wet processing includes all chemical operations necessary in Scouring, Bleaching, Mercerizing, Dyeing, Printing, Waterproofing, Mothproofing and other types of finishing of Cotton, Wool, Silk, and all Synthetic Fibers.

It is a technical phase of textile manufacture *entirely distinct* from *spinning, weaving and knitting.*

Consequently, the ideal medium for the advertising of products and apparatus used in wet processing operations is one which *reaches personally* the *individual* in *charge* of *these operations.*

1. A technical publication with subject matter solely of a character designed to be of value to all wet processing specialists.
2. A publication which eliminates waste circulation to spinners, weavers and knitters.
3. A publication with advertising rates in line with possible remuneration from sales.

The chemist, dyer, finisher, bleach and print room foreman are the key men to cultivate through advertising.

They are essentially students of research.

They prove the worth of a product by laboratory test and actual plant performance. They instigate and approve chemical and wet processing equipment purchases.

They recognize that wet-processing is an important factor contributing to fabric sales and their experience includes a broad understanding of the importance of consumer acceptance.

Advertising copy can, therefore, be broad in its appeal although specific technical information should be included.

In checking circulation figures of any textile publication *remember* that there are *over 2400 wet processing plants that buy chemicals, dyestuffs, finishing specialties, processing equipment, etc.*

From circulation figures that show a blanket coverage check for *actual mill circulation.* Then break this down to *mills that dye, bleach and finish plus commission dyers,* and the result will prove the worth of the publication to the advertiser who sells to wet processing plants *exclusively.*

All copies of the American Dyestuff Reporter are read by technical men in plants that perform wet processing operations.

The Reporter carries no advertising from manufacturers of looms, winding and spinning equipment, etc. The *mill circulation* of the Reporter represents *wet processing plants exclusively.* Consequently, the Reporter does not have to *justify a mill circulation* to manufacturers of weaving machinery, etc., *and at the same time* quote a circulation that should cover over 2400 wet processing plants if the advertising message of the manufacturers of dyestuffs, finishing compounds and chemical specialties is to reach the technical men in wet processing plants.

"I'm Just Dye-ing to tell you..."

SOLVAY LIQUID CHLORINE

Is a perfect performer in all bleaching operations

THERE'S NO DANGER OF OFF-SHADE colors when you use SOLVAY Liquid Chlorine for bleaching first. Not only does it act as a safeguard against spotty bleaching, but SOLVAY also acts as a water conditioner.

WHETHER YOU'RE DYEING cotton, wool, linen, rayon, you can be sure of perfect, uniform colors with SOLVAY Liquid Chlorine as the bleaching agent and water conditioner.

With SOLVAY you always get economical, controlled quality that is always uniform in performance.

- SAFEGUARDS AGAINST SPOTTY BLEACHING
- CONTROLS THE QUALITY OF WATER

SPECIFY QUALITY ...SPECIFY SOLVAY

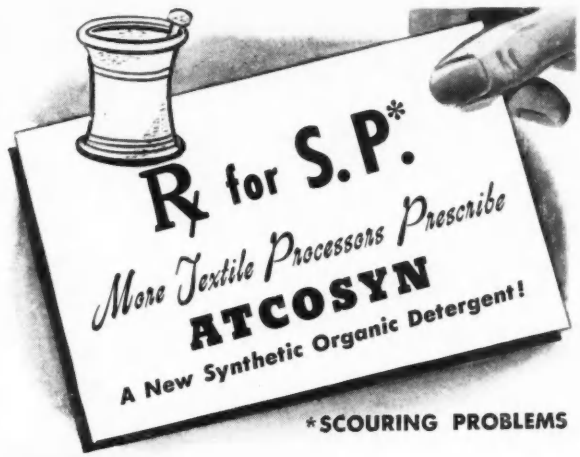
SOLVAY SALES CORPORATION

Alkalies and Chemical Products Manufactured by The Solvay Process Company

40 Rector Street **New York 6, N. Y.**

BRANCH SALES OFFICES:

Boston • Charlotte • Chicago • Cincinnati • Cleveland • Detroit
New Orleans • New York • Philadelphia • Pittsburgh • St. Louis • Syracuse



*SCOURING PROBLEMS

ATCOSYN ***FOR COTTONS AND RAYONS***

For scouring and boiling off all types of fabrics, applicable in continuous machines, jigs, boxes and all types of skein and package machines.

ATCOSYN ***FOR DYEING ALL TYPES OF FABRICS***

As a dyeing assistant, can be used as a dispersing agent for all classes of dyestuffs. Excellent dispersing agent for vat colors, both in box work and in vat pad dyeing. Promotes level dyeing and even shades.

ATCOSYN ***FOR WASHING OFF PRINTS — WASHING AFTER DYEING***

Brighter shades are obtained and crocking reduced to a minimum.

ATCOSYN ***FOR WOOL PROCESSING***

Can be used as a soap assistant, eliminating any precipitates and resulting in easy rinsing.

ASK FOR *complete technical data or sample of ATCOSYN.*

Use ATCO Products

Atlantic Chemical Co.

MAIN PLANT: CENTREDALE, RHODE ISLAND
BRANCH OFFICE: PATERSON, NEW JERSEY

AROMINE

DYE-BATH ASSISTANT

Wetting Agent . . . Dyeing Assistant . . . Water Normalizer . . . Produces Brighter Shades . . . For All Fabrics.

Effective in hard water, acid or alkaline baths.

BURKART-SCHIER CHEMICAL CO.
CHATTANOOGA, TENNESSEE

BURKOL

SYNTHETIC DETERGENT

A low cost synthetic organic compound of exceptionally high detergent value. Effective in hard water, acid, or alkaline baths.

BURKART-SCHIER CHEMICAL CO.
CHATTANOOGA, TENNESSEE

ALKAPEN

MERCERIZING ASSISTANT

The Alkapens . . . Penetrants for Dry Mercerizing . . . Wetting Agents Applied Directly in the Mercerizing Bath . . . For Yarns and Piece Goods.

BURKART-SCHIER CHEMICAL CO.
CHATTANOOGA, TENNESSEE

POLY-SCOUR

for Wetting . . . Scouring . . . Dyeing Nylon

BURKART-SCHIER CHEMICAL CO.
CHATTANOOGA, TENNESSEE

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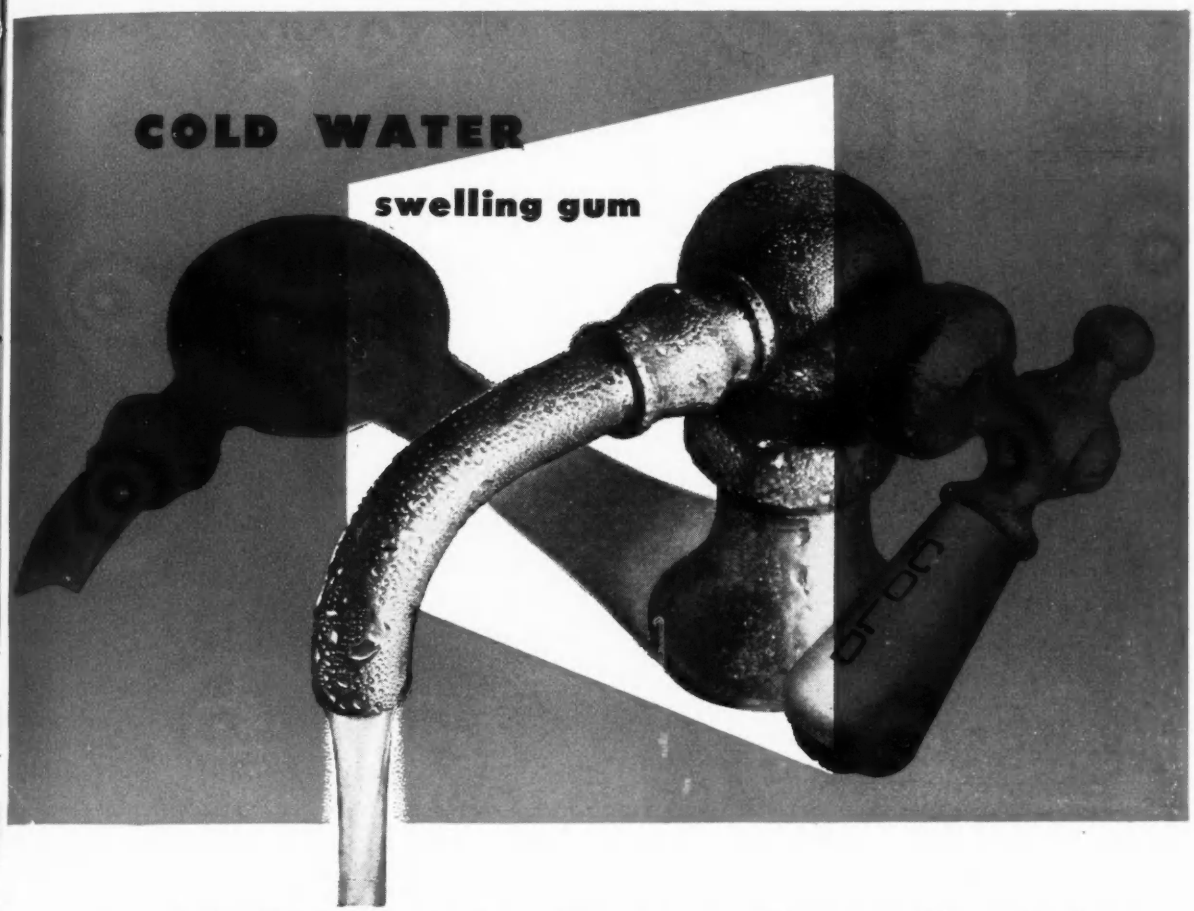


. . . . a challenge to all cook-up gums for textile printing

KOVAT swells in cold water to a smooth-textured, long-flowing consistency. It remains stable in the presence of strong alkalies and other chemicals. It produces prints of excellent color value, detail and penetration.

KOVAT is a definite challenge to all types of cook-up gums: *It saves time* — by mixing in cold water in 10 to 20 minutes. Cook-up gums require 3 to 4 hours. KOVAT *saves labor and equipment* — by using an ordinary drum or barrel and a portable agitator. Cook-up gums require a steam-jacketed kettle or other types of expensive equipment. KOVAT *saves storage space* — by being easily mixed in small batches as needed. Cook-up gums require storage facilities for large batches.

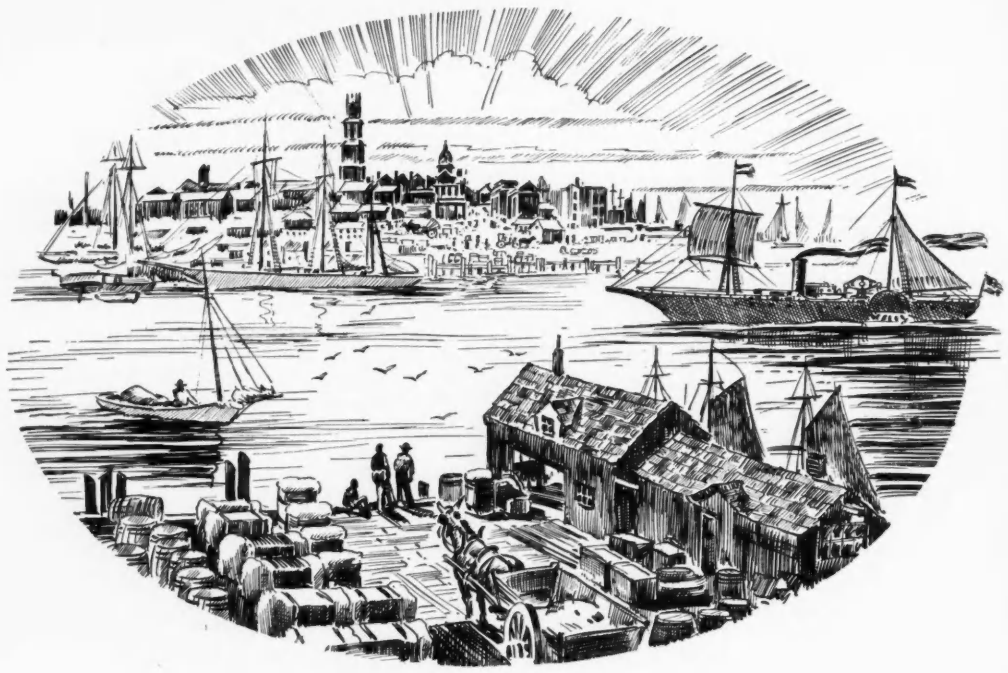
KOVAT has proved itself in commercial use by doing a better printing job with lower solids, less gum. It is especially recommended for vat color printing but is also highly efficient for other types of "wash fast" or "commercial" colors applied either by the roller machine or screen methods. Write for full information — NOW!

National also produces: AMBERTEX, a heavy-bodied gum for screen and machine printing; FIBERTEX, for textile finishing; FIBERJEL AC, a warp size for both filament Acetate and Viscose Rayon yarns; FLOJEL, uniform, thin boiling corn starches in all standard fluidities; and HOOSIER Pearl Cornstarch.

Offices: 270 Madison Avenue, New York 16; Boston, Philadelphia, Chicago, Indianapolis, New Orleans, San Francisco and other principal cities. In Canada: Meredith, Simmons & Co., Ltd., Toronto. In Holland: Nationale Zetmeelindustrie, N.V., Veendam.

National
STARCH PRODUCTS

STARCHES — AND *SPECIALTIES WITH EASILY DEMONSTRATED SUPERIORITY*



—back in 1820: When the first steamboat line was established between New York and New Orleans and Congress declared the foreign slave trade to be piracy—seven years before the first steam mill in the United States was erected—John Butterworth established this business in Philadelphia to serve the Textile Industry.

For 126 years we have kept in daily contact with the problems and opportunities of the Textile Industry . . . designing bigger machines for faster production . . . newer machines to meet special problems. We have watched the Textile Industry grow from a handful of family-sized plants to its present position as America's Second Industry. We are proud to have played a part in its development.

Butterworth Service includes a complete line of Machinery for bleaching, mercerizing, dyeing, drying, printing and finishing fabrics and warps; calenders for cotton and rayon fabrics; spinning machinery for rayon filament yarns.

Butterworth Research keeps informed on the new developments in Textiles and Textile-finishing. Butterworth Engineering strives to interpret each new development in terms of Machine Design and Plant Arrangement. Write us.

BUTTERWORTH

H. W. BUTTERWORTH & SONS COMPANY, Philadelphia 25, Pa.

TEXTILE FINISHING MACHINERY COMPANY DIVISION, Providence, R. I. . . 1211 Johnston Bldg., Charlotte, N. C. . . . W. J. Westaway Co., Hamilton, Ont. . . . . ARGENTINA: Storer & Cia., Chacabuco 443-49, Buenos Aires . . . . BRAZIL: Oscar Bandler, Caixa Postal 3193, Sao Paulo. CHILE: Schneiter & Cia., Ltda., Casilla 2864, Santiago . . . . COLOMBIA: C. E. Halaby & Co., Apartado 139, Medellin . . . . ECUADOR: Richard O. Custer, S. A., Quito . . . MEXICO: I. Slobotzky, Avenida Uruguay 55, Mexico, D. F. . . . PERU: Custer & Thommen, Casilla 733, Lima. URUGUAY: Storer & Cia., Ltda., Calle Paysandu 1022, Montevideo . . . . VENEZUELA: Herbert Zander & Co., Apartado Postal 1291, Caracas.